AD 426293

Final Report

Army Ordnance Contract DA-11-022-509-ORD-3070

ORD Project TB4-006D

Development of a Finishing System for Lightweight Metals

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Section I

Introduction

The object of this contract was to develop finishing systems for lightweight metals in both olive drab and white colors. The ultimate use of these systems would be on aircraft, missiles and rockets, ground transportation equipment, and related items. The substrate of primary concern was to be Dow 17 treated HK-31 magnesium alloy. Aluminum and steel were to be given secondary consideration. It was understood that any new magnesium alloys developed during the term of the contract would also be used as substrates.

The major requirements of the system are:

1. Applicable by spray.
2. Air dry, preferably quick dry type.
3. Ability to withstand temperatures up to 500°F. for short periods of time without losing film integrity.
4. Good film properties, such as hardness, toughness, adhesion, flexibility, durability, and corrosion resistance.
5. Resistance to aviation gasoline, and, if feasible, diester lubricant.
6. Good salt spray resistance, 2,000 hours alone, and 500 hours bimetallic coupling.
7. Quality control performed by general analytical and performance tests.

In addition, discussion with Army Ordnance Coating and Chemical Department personnel prior to the start of work on the contract brought out the following items:

1. A two coat system, primer plus topcoat, was preferable to a one coat system.
2. #2430 olive drab and untinted white were the desired colors for the topcoats. It was understood that the olive drab was of primary importance.
3. The gloss of the complete system was to be 15°-25° as measured at 60°.
4. The desired length of time for the coating to retain film integrity at 500°F. was 30 minutes minimum. If the coating could withstand 500°F. for 2 hours, this would be more desirable. The ability of the coating systems to withstand more than 500°F. was also to be evaluated.
5. The aviation gasoline to be used for test purposes was type III high aromatic content conforming to MIL-S-3136 while the diester lubricant was purified tricresyl phosphate as described in specification MIL-H-19457.

Section II

Initial Screening of Clear Films

Since a relatively high temperature was involved in this contract, it was believed a silicone was in order. These organic modified inorganic polymers are well known for their excellent heat resistance. The following silicones and silicone copolymers were chosen for initial screening:

1. General Electric SR-17
2. General Electric SR-28
3. General Electric SR-32
4. General Electric SR-82
5. General Electric SR-98 (now CR-116)
6. General Electric SR-111
7. General Electric SR-119
8. General Electric SR-120
9. Dow Corning DC-802
10. Dow Corning DC-803
11. Dow Corning DC-805
12. Dow Corning DC-806A
13. Dow Corning DC-840
14. Dow Corning XR-261
15. Dow Corning R-4471
16. Dow Corning R-6-0031
17. Dow Corning XR-856
18. Union Carbide R-64
19. Union Carbide R-630
20. Plaskon ST-847
21. Plaskon ST-856

It was realized that while silicones possess desirable high temperature properties, they are lacking in other respects such as ability to air dry and resistance to solvents. Accordingly, it was decided to modify them with a variety of organic materials to form composite resins which would have most of the properties needed. Clear resin blends were made containing 90, 75, and 50% silicone resin solids (in a few cases, 25% silicone content materials were also evaluated) while the remainder of the vehicle nonvolatile matter consisted of the following organic resins:

1. 1/2 second RS nitrocellulose
2. 1/2 second SS nitrocellulose
3. 1/2 second cellulose acetate butyrate
4. Polyvinyl butyral - Bakelite XYHL
5. Acrylic - Rohm and Haas Acryloid A-101
6. Styrene butadiene - Goodyear Pliolite S-5
7. Triazine formaldehyde - Rohm and Haas Uformite M-311
8. Polyvinyl formal - Shawinigan Formvar 7/70
9. Modified alkyd - Hercules Petrex SS
10. Epoxy ester - Midland Industrial Finishes Company R-55
11. Oxidizing alkyd - Midland Industrial Finishes Company R-9
12. Oxidizing alkyd - Midland Industrial Finishes Company R-50
13. Phenolic - Bakelite BRS-2600
14. Butadiene acrylonitrile - Naugatuck Paracril CV
15. Fossil resin - RBH 510

Since fluorinated hydrocarbon resins are also noted for their resistance to thermal degradation, some of these materials were modified in the same manner as the silicones. The following resins were used:

1. DuPont Viton A
2. Firestone Exon 461
3. Minnesota Mining and Manufacturing Fluorel
4. Minnesota Mining and Manufacturing Kel-F 800

The best finishing system for magnesium alloys prior to this contract was based on a polyamide cured epoxy. Consequently, the entire range of conventional bisphenol A-epichlorhydrin resins was catalyzed with various curing agents. Two silicone epoxy copolymers, Dow Corning XR-6-0000, and Midland X-4209, were investigated at the same time. The curing agents used were:

1. Versamid 100
2. Versamid 115
3. Versamid 125
4. Versamid 140
5. Genamid 250
6. Genamid 310
7. Lancast A
8. Dow Corning Z-6020 and XZ-2-2023, amino functional silanes
9. Diethylene triamine
10. Shell curing agents H-1 and H-2

Other film formers which were screened include:

1. Midland R-62, a heat resistant non-oxidizing alkyd.
2. Spencer Kellogg XP-1078 high temperature polyurethane
3. Roskydol 500 polyester
4. Reichhold Polylite 8702 and 8703 polyesters
5. Rohm and Haas Paraplex P-444 polyester
6. Isocyanate cured Dow Corning R-6-0031
7. Silicones cured with experimental silazane #2311
8. Food, Machinery, and Cnemical Company's Oxiron resins cured with PMDA adduct
9. Dow Chemical Company's epoxy novolac resins cured with PMDA adduct
10. Midland X-3928 silicone copolymer
11. Midland X-4415 silicone copolymer
12. Midland X-4323 silicone copolymer
13. Midland X-3934 urethane prepolymer
14. Archer Daniels Midland Aroflint 202-XA1-60 catalyzed resin
15. Shell Eponol H-55.1 - B-40 linear thermoplastic epoxy.

It was decided to perform relatively simple tests on these resin systems to eliminate as many of them as possible and therefore, make the more detailed evaluation much smaller in scope. After samples were prepared, the coatings were applied to 30 gauge steel with a 0.003" Bird applicator. The coatings were allowed to air dry for 24 hours after which they were tested as follows:

1. Air dry film properties such as dry, compatibility in the film, and adhesion were noted. See Table 1 for key to numbers used in rating film properties.

2. Panels were subjected to 500°F. for periods of 30 minutes and 2 hours. Any change in adhesion or loss of film integrity resulting from the heat exposure was noted. All coatings tested became dark in color after the heat test. See Table 1 for key to symbols used in rating heat resistance.

3. After allowing the coated panels to age for 96 hours, solvent resistance of the coatings was determined. Two small strips of each panel were cut, one strip being immersed for 4 hours in MIL-S-3136 fluid and the other being immersed for the same period in the lubricant. Any coating which softened was allowed to dry for 24 hours after which it was checked to see if it had regained its original hardness. See Table 1 for ratings used.

4. The wet samples of each coating were checked for storage stability after 1 month. Any gelation, stratification, or other ill effects were noted. See Table 1 for key to stability ratings.

Table 1

Key to Numerial Ratings and Symbols in Vehicle Screening Tables

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but soft	Good
3	Slightly Tacky	Fair
4	Tacky	Poor
5	Very Tacky	Extremely Poor

Compatibility

C - Compatible

H - Hazy

I - Incompatible

Stability

C - Compatible

H - Hazy

S - Stratified

Film Integrity

O.K. - No perceptible change except for darkening.

B - Blistered

N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Immersion

U - Unaffected

S - Softened

D - Dissolved

24 Hour Recovery

Yes - Recovered original properties

No - Did not recover original properties

Section III

Results of Screening Clear Coatings

A. Half Second Nitrocellulose Modification of Silicone Resins

1. The compatibility of unmodified silicones and nitrocellulose was poor while the compatibility of some of the silicone copolymers and nitrocellulose was good. Since most unmodified silicones are supplied with aromatic hydrocarbon solvents, a few of the commercially available 100% NVM silicones were dissolved in methyl isobutyl ketone and blended with nitrocellulose. Compatibility was still poor.

2. Compatibility and resistance to MIL-S-3136 fluid and diester lubricant were best at the 50% level of nitrocellulose.

3. After the heat exposures, systems with borderline compatibility often displayed blistering.

4. For the most part, the RS and SS grades of nitrocellulose were equivalent in performance.

5. For details of nitrocellulose modifications of silicone resins, see Tables 2 and 3.

Table 2

Half Second RS Nitrocellulose Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min @500F Adh.	30 min @500F Film Integrity	2 hr @500F Adh.	2 hr @500F Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-1-C	SR-28	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	2	4	5	B	4	B	S	NO	U	-
301-1-E	XR-261	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	O	2	2	B	4	B	U	-	U	-
301-2-A	SR-111	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	O	4	5	O.K.	4	O.K.	U	-	U	-
301-2-E	SR-17	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	O	4	4	O.K.	4	O.K.	U	-	U	-
301-2-G	ST-847	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	O	5	5	B	4	B	S	NO	U	-
301-2-K	DC-802	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	O	4	4	B	3	B	U	-	U	-
301-2-M	DC-803	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	O	4	4	B	3	B	U	-	U	-

Table 2 (continued)

Half Second RS Nitrocellulose Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility		30 day Stability	Air Dried Film		30 min @500F.		2 hr. @500F.		MIL-S3136 Fluid		Lubricant	
			Solution	Film		Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-3-A	DC-806A	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	1	4	2	B	4	B	U	-	U	-
301-3-C	R-6-0031	90	C	C	C	0	4	3	O.K.	2	O.K.	S	NO	S	NO
		75	C	C	C	0	3	2	O.K.	3	O.K.	S	NO	U	-
		50	C	C	C	0	1	3	O.K.	3	O.K.	U	-	U	-
301-3-E	SR-119	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	0	4	3	B	3	B	U	-	U	-
301-3-G	ST-856	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	C	C	C	0	3	3	O.K.	2	O.K.	S	YES	U	-
		50	C	C	C	0	3	4	O.K.	3	O.K.	U	-	U	-
301-3-K	XR-856	90	H	I	S	-	-	-	-	-	-	-	-	-	-
		75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	C	H	0	2	3	O.K.	4	O.K.	U	-	U	-
301-3-M	DC-805	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	0	4	4	B	4	B	U	-	U	-
301-4-A	SR-32	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	0	5	5	B	4	B	U	-	U	-

Table 2 (continued)

Half Second RS Nitrocellulose Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min @500F. Adh.	30 min @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-4-C	XR-630	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	O	4	4	B	4	B	U	-	U	-
301-4-E	SR-82	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	O	4	4	B	3	B	S	NO	U	-
301-4-G	DC-840	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	O	3	4	B	3	B	U	-	U	-
301-4-M	SR-120	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	C	S	O	5	4	B	5	B	S	NO	S	NO
		50	H	C	S	O	4	5	B	5	B	U	-	U	-
301-2-C	SR-98	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	I	S	-	-	-	-	-	-	-	-	-	-
301-5-E	R-4471	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	O	3	3	O.K.	3	O.K.	U	-	U	-

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Compatibility

C - Compatible
H - Hazy
I - Incompatible

Stability

C - Compatible
H - Hazy
S - Stratified

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

Table 3

Half Second SS Nitrocellulose Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility		30 day Stability	Air Dried Film		30 min @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
			Solution	Film		Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-1-D	SR-28	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	I	S	-	-	-	-	-	-	-	-	-	-
301-1-F	XR-261	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	0	3	2	B	3	B	U	-	U	-
301-2-B	SR-111	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	0	4	4	B	4	B	U	-	U	-
301-2-F	SR-17	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	1	3	5	B	5	B	U	-	U	-
301-2-H	ST-847	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	0	4	5	B	5	B	S	NO	U	-
301-2-L	DC-802	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	0	5	3	B	4	B	U	-	U	-
301-2-N	DC-803	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	0	4	4	B	3	B	U	-	U	-

Table 3 (continued)

Half Second SS Nitrocellulose Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min @500F. Adh.	30 min @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-3-B	DC-806A	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	O	4	4	B	3	B	U	-	U	-
301-3-D	R-6-0031	90	C	C	C	O	3	3	O.K.	4	O.K.	S	NO	S	NO
		75	C	C	C	O	4	3	O.K.	4	O.K.	S	NO	U	-
		50	C	C	C	O	4	3	O.K.	3	O.K.	U	-	U	-
301-3-F	SR-119	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	1	5	4	O.K.	4	O.K.	S	NO	S	NO
301-3-H	ST-856	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	C	S	O	4	4	O.K.	3	O.K.	S	YES	U	-
		50	C	C	C	O	4	4	O.K.	4	O.K.	U	-	U	-
301-3-L	XR-856	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	O	5	4	O.K.	4	O.K.	U	-	U	-
301-3-N	DC-805	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	O	4	4	B	4	B	U	-	U	-
301-4-B	SR-32	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	O	4	5	B	4	B	U	-	U	-

Table 3 (continued)

Half Second SS Nitrocellulose Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility		30 day	Air Dried Film		30 min @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
			Solution	Film	Stability	Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-4-D	XR-630	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	O	4	4	B	4	B	U	-	U	-
301-4-F	SR-82	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	O	4	3	B	3	B	S	NO	U	-
301-4-H	DC-840	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	O	4	3	B	3	B	S	NO	U	-
301-4-N	SR-120	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	I	-	-	-	-	-	-	-	-	-	-	-	-

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

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H - Hazy
I - Incompatible

Stability

C - Compatible
H - Hazy
S - Stratified

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

B. Half Second Cellulose Acetate Butyrate Modification of Silicone Resins

1. The compatibility of silicones and half second cellulose acetate butyrate was better than the nitrocellulose modified silicones but was still quite poor.

2. Again, compatibility and resistance to the test fluids were best at the 50% level of modifier.

3. Coatings which were subjected to the 500°F. heat test performed quite well in general.

4. For details of cellulose acetate butyrate modifications of silicone resins, see Table 4.

C. Acryloid A-101 Modification of Silicone Resins

1. The compatibility of silicones and Acryloid A-101 was quite good.

2. Resistance to the test fluids was poor with many of the coatings being completely soluble in the fluids.

3. The Acryloid A-101 modified silicone coatings withstood 500°F. very well.

4. For details of Acryloid A-101 modifications of silicone resins, see Table 5.

Table 4

Half Second Cellulose Acetate Butyrate Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min @ 500F. Adh.	30 min @ 500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-14-B	SR-28	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	C	H	S	O	4	4	O.K.	3	O.K.	S	NO	S	NO
		50	C	C	C	O	2	3	O.K.	2	O.K.	S	YES	S	NO
301-14-C	XR-261	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	H	S	O	3	3	O.K.	3	O.K.	S	NO	S	NO
		50	C	C	C	O	2	3	O.K.	3	O.K.	S	NO	S	NO
301-14-D	SR-111	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	I	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	O	2	3	O.K.	3	O.K.	S	NO	U	-
301-14-E	SR-98	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	O	4	-	-	-	-	S	NO	U	-
301-14-F	SR-17	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	I	S	O	4	-	-	-	-	-	-	-	-
		50	H	C	H	O	4	4	O.K.	4	O.K.	S	NO	U	-
301-14-G	ST-847	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	H	S	O	3	3	O.K.	2	O.K.	S	YES	U	-
301-14-H	DC-802	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	I	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	O	3	3	O.K.	3	O.K.	S	NO	U	-

Table 4 (continued)

Half Second Cellulose Acetate Butyrate Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min @500F. Adh.	30 min @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-14-K	DC-803	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	0	3	3	O.K.	3	O.K.	S	YES	U	-
301-14-L	DC-806A	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	H	S	0	3	2	O.K.	3	O.K.	S	NO	U	-
301-15-A	R-6-0031	90	C	C	C	1	3	1	O.K.	2	O.K.	D	-	D	-
		75	H	C	S	0	3	2	O.K.	2	O.K.	D	-	D	-
		50	H	H	S	0	3	1	O.K.	3	O.K.	D	-	S	YES
301-15-B	SR-119	90	H	I	S	-	-	-	-	-	-	-	-	-	-
		75	H	C	S	0	2	3	O.K.	4	O.K.	S	NO	S	NO
		50	H	C	S	0	2	2	O.K.	3	O.K.	S	YES	S	NO
301-15-C	ST-856	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	H	S	0	5	3	O.K.	3	O.K.	D	-	D	-
		50	H	C	S	0	5	2	O.K.	3	O.K.	D	-	U	-
301-15-D	XR-856	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	0	4	3	O.K.	3	O.K.	S	YES	U	-
301-15-E	DC-805	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	0	2	4	O.K.	3	O.K.	S	YES	U	-

Table 4 (continued)

Half Second Cellulose Acetate Butyrate Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min @500F. Adh.	30 min @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-15-F	SR-32	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	0	4	3	O.K.	3	O.K.	S	NO	U	-
301-15-G	XR-630	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	0	3	4	B	3	O.K.	S	NO	U	-
301-15-H	SR-82	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	C	C	C	0	1	2	B	2	O.K.	S	NO	S	NO
		50	C	C	C	0	2	3	O.K.	3	O.K.	S	YES	S	NO
301-15-K	DC-840	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	C	C	C	0	2	3	B	4	O.K.	S	NO	S	NO
		50	C	C	C	0	3	3	O.K.	4	O.K.	S	YES	S	NO
301-15-L	R-64	90	C	C	C	0	2	4	O.K.	3	O.K.	D	-	S	NO
		75	C	C	C	0	2	2	O.K.	3	O.K.	S	NO	S	NO
		50	C	C	C	0	3	3	O.K.	3	O.K.	S	YES	S	NO
301-15-M	SR-120	90	C	C	C	2	3	-	-	-	-	-	-	-	-
		75	C	C	C	0	3	3	O.K.	3	O.K.	S	YES	S	NO
		50	C	C	C	0	2	3	O.K.	3	O.K.	S	YES	S	NO

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Compatibility

C - Compatible
H - Hazy
I - Incompatible

Stability

C - Compatible
H - Hazy
S - Stratified

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

Table 5

Acrylic (Acryloid A-101) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility		30 day Stability	Air Dried Film		30 min @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
			Solution	Film		Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-22-A	SR-28	90	C	C	C	4	5	-	-	-	-	-	-	-	-
		75	C	C	C	0	5	4	O.K.	4	O.K.	D	-	D	-
		50	C	C	C	0	4	2	O.K.	3	O.K.	S	NO	U	-
301-22-B	XR-261	90	C	C	C	1	5	3	O.K.	4	O.K.	D	-	D	-
		75	C	C	C	1	3	4	O.K.	4	O.K.	D	-	D	-
		50	C	C	C	0	2	2	O.K.	4	O.K.	D	-	S	NO
301-22-C	SR-111	90	C	I	S	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	I	-	-	-	-	-	-	-	-	-	-	-	-
301-22-D	SR-98	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	I	-	-	-	-	-	-	-	-	-	-	-	-
301-22-E	SR-17	90	H	I	S	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	1	4	4	O.K.	4	O.K.	S	NO	S	NO
301-22-F	ST-847	90	H	C	S	0	4	4	O.K.	4	O.K.	D	-	S	NO
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	0	4	4	O.K.	2	O.K.	D	-	S	NO
301-22-G	DC-802	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	0	4	4	O.K.	3	O.K.	D	-	S	NO

Table 5 (continued)

Acrylic (Acryloid A-101) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min @500F. Adh.	30 min @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-22-H	DC-803	90	H	C	S	0	3	4	O.K.	3	O.K.	D	-	D	-
		75	H	I	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	0	3	3	O.K.	3	O.K.	S	NO	S	NO
301-22-K	DC-806A	90	H	C	S	0	3	4	O.K.	3	O.K.	D	-	D	-
		75	H	C	S	0	4	3	O.K.	2	O.K.	D	-	D	-
		50	H	C	S	0	2	3	O.K.	2	O.K.	S	NO	U	-
301-22-L	R-6-0031	90	C	C	C	1	5	3	O.K.	3	O.K.	D	-	D	-
		75	C	C	C	0	3	4	O.K.	2	O.K.	D	-	D	-
		50	H	C	H	0	4	4	O.K.	2	O.K.	D	-	U	-
301-23-A	SR-119	90	C	C	C	0	5	3	O.K.	4	O.K.	D	-	D	-
		75	C	C	C	0	5	3	O.K.	4	O.K.	D	-	D	-
		50	C	C	C	0	5	2	O.K.	2	O.K.	D	-	S	NO
301-23-B	ST-856	90	C	C	C	0	5	4	O.K.	3	O.K.	D	-	D	-
		75	H	C	S	0	4	3	O.K.	3	O.K.	D	-	D	-
		50	H	C	S	0	5	4	O.K.	3	O.K.	D	-	S	NO
301-23-C	XR-856	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	0	3	1	O.K.	2	O.K.	D	-	S	NO
301-23-D	DC-805	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	0	5	3	O.K.	3	O.K.	S	NO	U	-

Table 5 (continued)

Acrylic (Acryloid A-101) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility		30 day	Air Dried Film		30 min @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
			Solution	Film	Stability	Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-23-E	SR-32	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	1	4	3	O.K.	4	O.K.	S	NO	S	NO
301-23-F	XR-630	90	H	C	S	0	4	4	O.K.	3	O.K.	D	-	D	-
		75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	0	3	3	O.K.	3	O.K.	S	YES	U	-
301-23-G	SR-82	90	C	C	C	0	4	3	O.K.	4	O.K.	D	-	D	-
		75	C	C	C	0	2	4	O.K.	4	O.K.	D	-	D	-
		50	C	C	C	0	3	3	O.K.	2	O.K.	S	NO	U	-
301-23-H	DC-840	90	C	C	C	0	3	3	O.K.	4	O.K.	D	-	D	-
		75	C	C	C	0	3	2	O.K.	4	O.K.	D	-	D	-
		50	C	C	C	0	2	3	O.K.	2	O.K.	D	-	S	NO
301-23-L	SR-120	90	C	C	C	2	5	-	-	-	-	-	-	-	-
		75	C	C	C	1	5	3	O.K.	2	O.K.	D	-	D	-
		50	C	C	C	0	4	3	O.K.	4	O.K.	D	-	S	NO
301-23-K	R-64	90	C	C	C	0	3	3	O.K.	3	O.K.	D	-	D	-
		75	C	C	C	0	4	4	O.K.	4	O.K.	S	NO	D	-
		50	C	C	C	0	5	4	O.K.	4	O.K.	S	NO	S	NO
301-23-M	R-4471	90	H	I	S	-	-	-	-	-	-	-	-	-	-
		75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	H	S	0	1	1	B	1	B	S	NO	U	-

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Compatibility

C - Compatible
H - Hazy
I - Incompatible

Stability

C - Compatible
H - Hazy
S - Stratified

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

D. Polyvinyl Butyral Modification of Silicone Resins

1. The compatibility of Bakelite XYHL and silicone resins was very poor.

2. Resistance to MIL-S-3136 fluid and diester lubricant was extremely poor.

3. The film integrity of these coatings was good after the 500°F. heat exposure.

4. For details of Bakelite XYHL modifications of silicone resins, see Table 6.

E. Styrene Butadiene Modification of Silicone Resins

1. The compatibility of Pliolite S-5 and silicone resins was excellent.

2. These coatings did not air dry as well as most of the other systems which were evaluated.

3. Almost all the coatings were completely soluble in the test fluids.

4. Film properties after the heat exposure were good.

5. For details of Pliolite S-5 modifications of silicone resins, see Table 7.

Table 6

Polyvinyl Butyral (Bakelite XYHL) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility		30 day Stability	Air Dried Film		30 min @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
			Solution	Film		Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-10-B	SR-28	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	H	S	2	3	3	O.K.	2	O.K.	S	NO	S	NO
		50	H	C	S	1	2	3	O.K.	3	O.K.	S	NO	S	NO
301-10-C	XR-261	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	C	S	1	3	2	O.K.	2	O.K.	S	YES	S	NO
		50	H	C	S	0	2	3	O.K.	3	O.K.	S	NO	S	NO
301-10-D	SR-111	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	0	4	4	O.K.	4	O.K.	S	NO	S	NO
301-10-E	SR-98	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	0	3	4	O.K.	4	O.K.	S	NO	S	YES
301-10-F	SR-17	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	2	3	4	O.K.	4	O.K.	S	NO	S	NO
301-10-G	ST-847	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	H	S	0	2	2	O.K.	3	O.K.	S	NO	S	NO
301-10-H	DC-802	90	H	I	S	-	-	-	-	-	-	-	-	-	-
		75	H	H	S	1	5	4	O.K.	3	O.K.	S	NO	S	NO
		50	H	H	S	1	4	3	O.K.	3	O.K.	S	NO	S	NO

Table 6 (continued)

Polyvinyl Butyral (Bakelite XYHL) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min @ 500F. Adh.	30 min @ 500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-10-K	DC-803	90	H	I	S	-	-	-	-	-	-	-	-	-	-
		75	H	H	S	O	3	4	O.K.	3	O.K.	S	NO	S	NO
		50	H	H	S	O	2	4	O.K.	3	O.K.	S	NO	S	YES
301-10-L	DC-806A	90	H	I	S	-	-	-	-	-	-	-	-	-	-
		75	H	H	S	O	3	4	O.K.	3	O.K.	S	NO	U	-
		50	H	H	S	O	3	3	O.K.	3	O.K.	S	NO	U	-
301-11-A	R-6-0031	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	H	S	O	3	3	O.K.	3	O.K.	S	NO	D	-
		50	H	H	S	O	2	1	O.K.	3	O.K.	S	NO	S	NO
301-11-B	SR-119	90	H	I	-	-	-	-	-	-	-	-	-	-	-
		75	H	H	S	2	5	3	O.K.	3	O.K.	D	-	D	-
		50	H	H	S	O	4	3	O.K.	3	O.K.	D	-	S	NO
301-11-C	ST-856	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	H	S	O	2	4	O.K.	3	O.K.	D	-	S	NO
		50	H	H	S	O	5	3	O.K.	3	O.K.	D	-	S	NO
301-11-D	XR-856	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	H	S	O	3	2	O.K.	3	O.K.	S	NO	U	-
301-11-E	DC-805	90	H	I	S	-	-	-	-	-	-	-	-	-	-
		75	H	H	S	2	4	4	O.K.	4	O.K.	D	-	S	NO
		50	H	H	S	O	4	4	O.K.	4	O.K.	S	NO	U	-

Table 6 (continued)

Polyvinyl Butyral (Bakelite XYHL) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min @500F. Adh.	30 min @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-11-F	SR-32	90	H	I	S	-	-	-	-	-	-	-	-	-	-
		75	H	H	S	3	5	4	O.K.	4	O.K.	D	-	S	NO
		50	H	H	S	0	3	2	O.K.	3	O.K.	S	NO	U	-
301-11-G	XR-630	90	H	H	S	1	3	5	O.K.	5	O.K.	D	-	D	-
		75	H	H	S	1	3	5	O.K.	5	O.K.	D	-	D	-
		50	H	C	S	0	3	4	O.K.	4	O.K.	S	NO	S	NO
301-11-H	SR-82	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	C	S	0	1	1	O.K.	1	O.K.	S	NO	S	NO
		50	H	C	S	0	1	1	O.K.	3	O.K.	S	YES	S	NO
301-11-K	DC-840	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	H	S	0	3	3	O.K.	3	O.K.	S	NO	S	NO
301-11-L	R-64	90	H	C	S	0	2	3	O.K.	2	O.K.	D	-	D	-
		75	H	C	S	0	3	3	O.K.	3	O.K.	S	NO	S	NO
		50	H	C	S	0	3	3	O.K.	3	O.K.	S	NO	S	NO
301-11-M	SR-120	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	I	S	-	-	-	-	-	-	-	-	-	-
301-11-N	R-4471	90	H	I	S	-	-	-	-	-	-	-	-	-	-
		75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	I	H	-	-	-	-	-	-	-	-	-	-

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Compatibility

C - Compatible
H - Hazy
I - Incompatible

Stability

C - Compatible
H - Hazy
S - Stratified

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

Table 7

Styrene Butadiene (Pliolite S-5) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min @500F. Adh.	30 min @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-34-B	SR-28	90	C	C	S	5	-	-	-	-	-	-	-	-	-
		75	C	C	C	5	-	-	-	-	-	-	-	-	-
		50	C	C	C	3	4	4	O.K.	5	O.K.	D	-	D	-
301-34-C	XR-261	90	C	C	S	1	4	4	O.K.	4	O.K.	D	-	D	-
		75	C	C	S	0	4	4	O.K.	4	O.K.	D	-	D	-
		50	C	C	C	0	4	4	O.K.	4	O.K.	D	-	D	-
301-34-D	SR-111	90	C	C	S	5	-	-	-	-	-	-	-	-	-
		75	C	C	S	5	-	-	-	-	-	-	-	-	-
		50	C	C	C	3	4	4	O.K.	4	O.K.	D	-	D	-
301-34-E	SR-98	90	C	C	C	0	3	5	O.K.	4	O.K.	D	-	D	-
		75	C	H	C	0	4	4	O.K.	5	O.K.	D	-	D	-
		50	C	C	C	0	4	5	O.K.	5	O.K.	D	-	D	-
301-34-F	SR-17	90	C	C	S	5	-	-	-	-	-	-	-	-	-
		75	C	C	S	5	-	-	-	-	-	-	-	-	-
		50	C	C	S	3	4	4	O.K.	4	O.K.	D	-	D	-
301-34-G	ST-847	90	C	C	S	0	3	3	O.K.	2	O.K.	S	YES	S	NO
		75	C	C	S	0	4	3	O.K.	2	O.K.	S	YES	S	NO
		50	C	C	C	0	4	3	O.K.	3	O.K.	D	-	S	NO
301-34-H	DC-802	90	C	C	S	3	3	3	O.K.	3	O.K.	D	-	S	NO
		75	C	C	S	2	3	3	O.K.	3	O.K.	D	-	D	-
		50	C	C	S	1	4	4	O.K.	4	O.K.	D	-	S	NO

Table 7 (continued)

Styrene Butadiene (Pliolite S-5) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility		30 day	Air Dried Film		30 min @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
			Solution	Film	Stability	Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-34-K	DC-803	90	C	C	S	0	3	3	O.K.	3	O.K.	D	-	D	-
		75	C	C	S	1	3	3	O.K.	3	O.K.	D	-	D	-
		50	C	C	S	0	4	4	O.K.	4	O.K.	D	-	D	-
301-34-L	DC-806A	90	C	C	C	0	3	3	O.K.	3	O.K.	D	-	D	-
		75	C	C	C	0	3	3	O.K.	3	O.K.	D	-	D	-
		50	C	C	C	0	3	4	O.K.	4	O.K.	D	-	D	-
301-35-A	R-6-0031	90	C	C	S	1	4	3	O.K.	2	O.K.	S	NO	D	-
		75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	C	C	S	1	3	4	O.K.	4	O.K.	S	YES	S	NO
301-35-B	SR-119	90	C	C	S	5	-	-	-	-	-	-	-	-	-
		75	C	C	S	5	-	-	-	-	-	-	-	-	-
		50	C	C	S	1	4	4	O.K.	4	O.K.	D	-	S	NO
301-35-C	ST-856	90	C	C	S	0	2	2	O.K.	3	O.K.	D	-	S	NO
		75	C	C	S	1	3	3	O.K.	2	O.K.	D	-	S	NO
		50	C	C	S	0	3	4	O.K.	4	O.K.	S	YES	S	NO
301-35-D	XR-856	90	C	C	S	1	4	3	O.K.	3	O.K.	D	-	D	-
		75	C	C	S	0	4	3	O.K.	4	O.K.	D	-	D	-
		50	C	C	S	0	3	4	O.K.	4	O.K.	D	-	D	-
301-35-E	DC-805	90	C	C	S	0	4	2	O.K.	2	O.K.	D	-	D	-
		75	C	C	S	o	4	3	O.K.	3	O.K.	D	-	D	-
		50	C	C	S	0	4	4	O.K.	4	O.K.	D	-	D	-

Table 7 (continued)

Styrene Butadiene (Pliolite S-5) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility		30 day Stability	Air Dried Film		30 min @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
			Solution	Film		Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-35-F	SR-32	90	C	C	S	5	-	-	-	-	-	-	-	-	-
		75	C	C	S	5	-	-	-	-	-	-	-	-	-
		50	C	C	S	0	3	3	O.K.	3	O.K.	D	-	S	NO
301-35-G	XR-630	90	C	C	S	1	3	2	O.K.	2	O.K.	D	-	S	NO
		75	C	C	S	0	3	3	O.K.	3	O.K.	D	-	D	-
		50	C	H	S	0	3	3	O.K.	3	O.K.	D	-	D	-
301-35-H	SR-82	90	C	C	S	1	4	3	O.K.	3	O.K.	D	-	D	-
		75	C	H	C	0	3	4	O.K.	4	O.K.	D	-	D	-
		50	C	C	C	0	4	4	O.K.	4	O.K.	D	-	S	NO
301-35-K	DC-840	90	C	H	S	0	4	3	O.K.	3	O.K.	D	-	D	-
		75	C	H	C	0	4	4	O.K.	3	O.K.	D	-	D	-
		50	C	C	C	0	3	4	O.K.	4	O.K.	D	-	D	-
301-35-L	R-64	90	H	C	S	0	3	4	O.K.	4	O.K.	D	-	D	-
		75	C	C	S	0	3	3	O.K.	4	O.K.	D	-	D	-
		50	C	C	S	0	4	4	O.K.	4	O.K.	D	-	D	-
301-35-M	SR-120	90	H	C	S	5	-	-	-	-	-	-	-	-	-
		75	C	C	S	5	-	-	-	-	-	-	-	-	-
		50	C	C	S	0	4	3	O.K.	3	O.K.	D	-	S	NO
301-35-N	R-4471	90	C	C	S	1	3	3	O.K.	3	O.K.	D	-	D	-
		75	C	C	S	0	4	4	O.K.	3	O.K.	D	-	D	-
		50	C	C	S	0	4	4	O.K.	4	O.K.	D	-	D	-

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Compatibility

C - Compatible
H - Hazy
I - Incompatible

Stability

C - Compatible
H - Hazy
S - Stratified

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

F. Triazine Formaldehyde Modification of Silicone Resins.

1. The compatibility of silicones and Uformite M-311 was fairly good.

2. Many of the coatings were still quite tacky after a 24-hour air dry period.

3. Resistance to the test fluids, particularly to the diester lubricant, was very poor.

4. Heat resistance was good.

5. For details of Uformite M-331 modifications of silicone resins, see Table 8.

G. Polyvinyl Formal Modification of Silicone Resins

1. The compatibility of silicones and Formvar 7/70 was very poor.

2. The best resistance to the test fluids was obtained with coatings containing 50% Formvar 7/70.

3. The film integrity of the coatings after the 500°F. heat exposure was good.

4. For details of Formvar 7/70 modifications of silicone resins, see Table 9.

Table 8

Triazine Formaldehyde (Uformite M-311) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min @500F. Adh.	30 min @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-38-A	SR-28	90	C	C	C	5	-	-	-	-	-	-	-	-	-
		75	C	C	C	5	-	-	-	-	-	-	-	-	-
		50	C	C	C	3	4	3	O.K.	3	O.K.	D	-	D	-
301-38-B	XR-261	90	C	C	C	1	3	4	O.K.	4	O.K.	D	-	D	-
		75	C		C	1	3	4	O.K.	4	O.K.	D	-	D	-
		50	H	C	H	0	2	3	O.K.	4	O.K.	D	-	D	-
301-38-C	SR-111	90	H	H	S	5	-	-	-	-	-	-	-	-	-
		75	H	H	S	5	-	-	-	-	-	-	-	-	-
		50	H	H	S	4	3	5	O.K.	4	O.K.	D	-	D	-
301-38-D	SR-98	90	H	H	S	0	3	5	O.K.	4	O.K.	D	-	D	-
		75	H	H	S	0	4	4	O.K.	3	O.K.	D	-	D	-
		50	H	H	S	0	3	3	O.K.	4	O.K.	D	-	D	-
301-38-E	SR-17	90	H	H	S	5	-	-	-	-	-	-	-	-	-
		75	H	H	S	5	-	-	-	-	-	-	-	-	-
		50	H	H	S	4	3	5	O.K.	5	O.K.	D	-	D	-
301-38-F	ST-847	90	C	C	C	0	2	2	O.K.	3	O.K.	S	YES	S	NO
		75	C	C	C	0	1	2	O.K	3	O.K.	D	-	S	NO
		50	C	C	C	0	2	3	O.K.	3	O.K.	D	-	S	NO
301-38-G	DC-802	90	H	H	S	5	-	-	-	-	-	-	-	-	-
		75	H	H	S	3	4	4	O.K.	4	O.K.	D	-	D	-
		50	H	H	S	3	3	5	O.K.	4	O.K.	D	-	D	-

Table 8 (continued)

Triazine Formaldehyde (Uformite M-311) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min @500F. Adh.	30 min @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-38-H	DC-803	90	H	C	S	0	3	3	O.K.	4	O.K.	S	YES	D	-
		75	H	C	S	0	2	3	O.K.	3	O.K.	D	-	D	-
		50	H	H	S	0	2	3	O.K.	4	O.K.	S	NO	D	-
301-38-K	DC-806A	90	H	C	S	0	3	3	O.K.	4	O.K.	D	-	D	-
		75	H	H	S	0	2	3	O.K.	4	O.K.	S	YES	D	-
		50	H	H	S	0	2	5	O.K.	3	O.K.	S	YES	D	-
301-38-L	R-6-0031	90	C	C	C	0	3	4	O.K.	3	O.K.	S	NO	D	-
		75	C	C	C	1	3	2	O.K.	3	O.K.	S	NO	D	-
		50	C	C	C	0	2	2	O.K.	3	O.K.	D	-	D	-
301-38-M	SR-119	90	C	C	C	5	-	-	-	-	-	-	-	-	-
		75	C	C	C	5	-	-	-	-	-	-	-	-	-
		50	C	C	C	1	3	4	O.K.	4	O.K.	S	YES	D	-
301-39-A	ST-856	90	C	C	C	0	2	3	O.K.	3	O.K.	D	-	D	-
		75	C	C	C	0	2	1	O.K.	2	O.K.	D	-	D	-
		50	C	C	C	0	2	2	O.K.	3	O.K.	D	-	D	-
301-39-B	XR-856	90	H	C	S	0	3	4	O.K.	4	O.K.	S	YES	D	-
		75	H	C	S	0	2	4	O.K.	4	O.K.	S	YES	D	-
		50	H	H	S	0	2	4	O.K.	4	O.K.	D	-	D	-
301-39-C	DC-805	90	H	H	S	5	-	-	-	-	-	-	-	-	-
		75	H	H	S	5	-	-	-	-	-	-	-	-	-
		50	H	H	S	0	3	3	O.K.	3	O.K.	D	-	D	-

Table 8 (continued)

Triazine Formaldehyde (Uformite M-311) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min. @500F. Adh.	30 min. @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-39-D	SR-32	90	H	H	S	5	-	-	-	-	-	-	-	-	-
		75	H	H	S	5	-	-	-	-	-	-	-	-	-
		50	H	H	S	5	-	-	-	-	-	-	-	-	-
301-39-E	XR-630	90	H	H	H	1	2	4	O.K.	4	O.K.	D	-	D	-
		75	H	H	S	0	2	4	O.K.	3	O.K.	D	-	S	NO
		50	H	H	S	0	3	3	O.K.	3	O.K.	D	-	S	NO
301-39-F	SR-82	90	C	C	C	0	2	3	O.K.	4	O.K.	D	-	D	-
		75	C	C	C	0	2	3	O.K.	3	O.K.	D	-	D	-
		50	C	C	C	0	3	4	O.K.	4	O.K.	D	-	D	-
301-39-G	DC-840	90	C	C	C	0	3	3	O.K.	4	O.K.	D	-	D	-
		75	C	C	C	0	2	4	O.K.	3	O.K.	D	-	D	-
		50	C	C	C	0	2	4	O.K.	3	O.K.	D	-	D	-
301-39-H	R-64	90	C	C	C	0	1	3	O.K.	3	O.K.	S	YES	D	-
		75	C	C	C	0	2	3	O.K.	4	O.K.	S	YES	D	-
		50	C	C	C	0	1	3	O.K.	4	O.K.	D	-	D	-
301-39-K	SR-120	90	C	C	C	5	-	-	-	-	-	-	-	-	-
		75	C	C	C	2	4	2	O.K.	3	O.K.	D	-	D	-
		50	C	C	C	0	2	2	O.K.	3	O.K.	D	-	D	-
301-39-L	R-4471	90	H	C	H	0	3	2	O.K.	4	O.K.	D	-	D	-
		75	H	C	S	0	2	4	O.K.	3	O.K.	S	YES	D	-
		50	H	H	H	0	4	4	O.K.	3	O.K.	D	-	D	-

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Compatibility

C - Compatible
H - Hazy
I - Incompatible

Stability

C - Compatible
H - Hazy
S - Stratified

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

Table 9

Polyvinyl Formal (Formvar 7/70) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min. @500F. Adh.	30 min. @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-42-B	SR-28	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	H	S	5	-	-	-	-	-	-	-	-	-
		50	H	H	S	2	3	3	O.K.	3	O.K.	S	YES	U	-
301-42-C	XR-261	90	H	I	S	-	-	-	-	-	-	-	-	-	-
		75	H	H	S	2	3	2	O.K.	2	O.K.	S	NO	D	-
		50	H	H	H	1	4	3	O.K.	3	O.K.	S	YES	U	-
301-42-D	SR-111	90	H	H	S	5	-	-	-	-	-	-	-	-	-
		75	H	H	S	5	-	-	-	-	-	-	-	-	-
		50	H	H	S	4	3	3	O.K.	3	O.K.	S	NO	U	-
301-42-E	SR-98	90	H	H	S	1	4	3	O.K.	3	O.K.	S	NO	U	-
		75	H	C	S	0	3	3	O.K.	3	O.K.	U	-	U	-
		50	H	C	S	0	4	3	O.K.	3	O.K.	S	YES	U	-
301-42-F	SR-17	90	H	H	S	5	-	-	-	-	-	-	-	-	-
		75	H	H	S	5	-	-	-	-	-	-	-	-	-
		50	H	H	S	4	5	-	-	-	-	-	-	-	-
301-42-G	ST-847	90	H	C	S	1	3	3	O.K.	2	O.K.	D	-	D	-
		75	H	C	H	1	3	3	O.K.	3	O.K.	D	-	D	-
		50	H	I	H	-	-	-	-	-	-	-	-	-	-
301-42-H	DC-802	90	H	H	S	5	-	-	-	-	-	-	-	-	-
		75	H	H	S	5	-	-	-	-	-	-	-	-	-
		50	H	H	S	1	4	4	O.K.	4	O.K.	S	YES	S	YES

Table 9 (continued)

Polyvinyl Formal (Formvar 7/70) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min. @500F. Adh.	30 min. @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-42-K	DC-803	90	H	C	S	0	3	4	O.K.	4	O.K.	D	-	D	-
		75	H	C	S	0	3	4	O.K.	4	O.K.	S	NO	U	-
		50	H	H	S	0	5	-	-	-	-	-	-	-	-
301-43-A	DC-806A	90	H	H	S	0	3	3	O.K.	3	O.K.	D	-	D	-
		75	H	H	S	0	4	3	O.K.	3	O.K.	S	NO	D	-
		50	H	H	S	0	4	4	O.K.	4	O.K.	S	YES	U	-
301-43-B	R-6-0031	90	H	H	S	3	3	3	O.K.	3	O.K.	S	NO	D	-
		75	H	H	S	1	3	3	O.K.	3	O.K.	S	NO	S	NO
		50	H	H	S	1	4	3	O.K.	3	B	S	YES	U	-
301-43-C	SR-119	90	H	C	S	0	3	3	O.K.	3	O.K.	S	NO	D	-
		75	H	C	S	0	3	3	O.K.	3	O.K.	S	NO	D	-
		50	H	C	S	0	4	3	O.K.	3	O.K.	S	YES	U	-
301-43-D	ST-856	90	H	C	S	0	3	3	O.K.	3	O.K.	S	NO	D	-
		75	H	H	S	0	2	3	O.K.	3	O.K.	D	-	D	-
		50	H	H	S	0	4	3	O.K.	4	O.K.	S	NO	U	-
301-43-E	XR-856	90	H	C	S	3	4	4	O.K.	3	O.K.	D	-	D	-
		75	H	C	S	2	3	4	O.K.	4	O.K.	S	NO	D	-
		50	H	C	S	2	4	4	O.K.	4	O.K.	S	YES	U	-
301-43-F	DC-805	90	H	H	S	5	-	-	-	-	-	-	-	-	-
		75	H	H	S	5	-	-	-	-	-	-	-	-	-
		50	H	H	S	2	4	4	O.K.	4	O.K.	S	YES	U	-

Table 9 (continued)

Polyvinyl Formal (Formvar 7/70) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min @500F. Adh.	30 min @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-43-G	SR-32	90	H	H	S	5	-	-	-	-	-	-	-	-	-
		75	H	H	S	5	-	-	-	-	-	-	-	-	-
		50	H	H	S	2	4	3	O.K.	3	O.K.	S	YES	U	-
301-43-H	XR-630	90	H	C	S	0	5	-	-	-	-	-	-	-	-
		75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	0	3	3	O.K.	3	O.K.	S	YES	U	-
301-44-A	SR-82	90	C	C	C	0	3	3	O.K.	3	O.K.	S	NO	D	-
		75	C	C	C	0	3	3	O.K.	3	O.K.	S	YES	D	-
		50	C	C	C	0	3	4	B	3	O.K.	S	YES	U	-
301-44-B	DC-840	90	H	C	S	0	3	3	O.K.	3	O.K.	S	NO	D	-
		75	H	H	S	0	3	3	O.K.	3	O.K.	S	YES	U	-
		50	H	H	S	0	3	3	O.K.	3	O.K.	S	YES	U	-
301-44-C	R-64	90	H	C	S	0	3	3	O.K.	3	O.K.	S	NO	D	-
		75	H	H	S	0	3	3	O.K.	3	O.K.	S	NO	D	-
		50	H	C	S	0	3	4	O.K.	3	O.K.	S	YES	U	-
301-44-D	SR-120	90	H	H	S	5	-	-	-	-	-	-	-	-	-
		75	H	H	S	5	-	-	-	-	-	-	-	-	-
		50	H	H	S	5	-	-	-	-	-	-	-	-	-
301-44-E	R-4471	90	H	H	S	5	-	-	-	-	-	-	-	-	-
		75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	H	S	1	3	3	O.K.	3	O.K.	S	NO	U	-

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4.	Tacky	Poor
5	Very tacky	Extremely Poor

Compatibility

C - Compatible
H - Hazy
I - Incompatible

Stability

C - Compatible
H - Hazy
S - Stratified

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

H. Modified Alkyd (Petrex SS) Modification of Silicone Resins

1. The compatibility of Petrex SS and silicone resins was good.

2. Coatings containing Petrex SS did not air dry well.

3. All coatings were dissolved by the test fluids.

4. Heat resistance of coatings containing Petrex SS was good.

5. For details of Petrex SS modifications of silicone resins, see Table 10.

I. Epoxy Ester Modification of Silicone Resins

1. The compatibility of silicone resins and Midland R-55 was generally good.

2. Only coatings containing 75% epoxy ester air dried satisfactorily.

3. Resistance to MIL-S-3136 fluid and diester lubricant was fair.

4. Heat resistance of coatings containing Midland R-55 was good.

5. For details of Midland R-55 modifications of silicone resins, see Table 11.

Table 10

Petrex SS Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility		30 day	Air Dried Film		30 min @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
			Solution	Film	Stability	Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-65-B	SR-28	90	-	-	-	5	-	-	-	-	-	-	-	-	-
		75	-	-	-	5	-	-	-	-	-	-	-	-	-
		50	-	-	-	5	-	-	-	-	-	-	-	-	-
301-65-C	XR-261	90	-	-	-	5	-	-	-	-	-	-	-	-	-
		75	-	-	-	5	-	-	-	-	-	-	-	-	-
		50	-	-	-	5	-	-	-	-	-	-	-	-	-
301-65-D	SR-111	90	-	-	-	5	-	-	-	-	-	-	-	-	-
		75	-	-	-	5	-	-	-	-	-	-	-	-	-
		50	-	-	-	5	-	-	-	-	-	-	-	-	-
301-65-E	SR-98	90	-	-	-	5	-	-	-	-	-	-	-	-	-
		75	-	-	-	5	-	-	-	-	-	-	-	-	-
		50	C	C	S	0	3	5	O.K.	4	O.K.	D	-	D	-
301-65-F	SR-17	90	-	-	-	5	-	-	-	-	-	-	-	-	-
		75	-	-	-	5	-	-	-	-	-	-	-	-	-
		50	-	-	-	5	-	-	-	-	-	-	-	-	-
301-65-G	ST-847	90	C	C	C	0	3	3	O.K.	4	O.K.	D	-	D	-
		75	C	C	C	0	3	3	O.K.	3	O.K.	D	-	D	-
		50	C	C	C	0	3	3	O.K.	3	O.K.	D	-	D	-
301-65-H	DC-802	90	-	-	-	5	-	-	-	-	-	-	-	-	-
		75	-	-	-	5	-	-	-	-	-	-	-	-	-
		50	-	-	-	5	-	-	-	-	-	-	-	-	-

Table 10 (continued)

Petrex SS Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility		30 day Stability	Air Dried Film		30 min @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
			Solution	Film		Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-65-K	DC-803	90	-	-	-	5	-	-	-	-	-	-	-	-	-
		75	C	C	C	0	3	3	O.K.	4	O.K.	D	-	D	-
		50	C	C	C	0	3	4	O.K.	4	O.K.	D	-	D	-
301-65-L	DC-806A	90	-	-	-	5	-	-	-	-	-	-	-	-	-
		75	C	C	C	0	3	3	O.K.	3	O.K.	D	-	D	-
		50	C	C	C	0	5	4	O.K.	3	O.K.	D	-	D	-
301-65-M	R-6-0031	90	C	C	C	1	3	3	O.K.	3	O.K.	D	-	D	-
		75	C	C	C	0	3	3	O.K.	3	O.K.	D	-	D	-
		50	C	C	C	0	3	4	O.K.	3	O.K.	D	-	D	-
301-66-A	SR-119	90	-	-	-	5	-	-	-	-	-	-	-	-	-
		75	-	-	-	5	-	-	-	-	-	-	-	-	-
		50	-	-	-	5	-	-	-	-	-	-	-	-	-
301-66-B	ST-856	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	H	H	0	5	3	O.K.	3	O.K.	D	-	D	-
		50	H	H	H	0	4	3	O.K.	4	O.K.	D	-	D	-
301-66-C	XR-856	90	I	-	-	-	-	-	-	-	-	-	-	-	-
		75	H	H	H	0	3	4	O.K.	4	O.K.	D	-	D	-
		50	C	C	C	0	3	4	O.K.	4	O.K.	D	-	D	-
301-66-D	DC-805	90	-	-	-	5	-	-	-	-	-	-	-	-	-
		75	-	-	-	5	-	-	-	-	-	-	-	-	-
		50	-	-	-	5	-	-	-	-	-	-	-	-	-

Table 10 (continued)

Petrex SS Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min. @500F. Adh.	30 min. @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-66-E	SR-32	90	-	-	-	5	-	-	-	-	-	-	-	-	-
		75	-	-	-	5	-	-	-	-	-	-	-	-	-
		50	-	-	-	5	-	-	-	-	-	-	-	-	-
301-66-F	XR-630	90	C	C	C	0	3	4	O.K.	4	O.K.	D	-	D	-
		75	C	C	C	0	3	4	O.K.	4	O.K.	D	-	D	-
		50	C	C	C	0	4	3	O.K.	4	O.K.	D	-	D	-
301-66-G	SR-82	90	-	-	-	5	-	-	-	-	-	-	-	-	-
		75	-	-	-	5	-	-	-	-	-	-	-	-	-
		50	-	-	-	5	-	-	-	-	-	-	-	-	-
301-66-H	DC-840	90	-	-	-	5	-	-	-	-	-	-	-	-	-
		75	-	-	-	5	-	-	-	-	-	-	-	-	-
		50	-	-	-	5	-	-	-	-	-	-	-	-	-
301-66-K	R-64	90	C	C	C	0	3	4	O.K.	4	O.K.	D	-	D	-
		75	C	C	C	0	3	4	O.K.	4	O.K.	D	-	D	-
		50	C	C	C	0	4	4	O.K.	4	O.K.	D	-	D	-
301-66-L	SR-120	90	-	-	-	5	-	-	-	-	-	-	-	-	-
		75	-	-	-	5	-	-	-	-	-	-	-	-	-
		50	C	C	C	2	3	4	O.K.	4	O.K.	D	-	D	-
301-66-M	R-4471	90	H	I	S	-	-	-	-	-	-	-	-	-	-
		75	C	C	C	0	3	4	O.K.	3	O.K.	D	-	D	-
		50	C	C	C	0	5	4	O.K.	3	O.K.	D	-	D	-

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Compatibility

C - Compatible
H - Hazy
I - Incompatible

Stability

C - Compatible
H - Hazy
S - Stratified

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

Table 11

Epoxy Ester (Midland R-55) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min. @500F. Adh.	30 min. @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-69-B	SR-98	90	-	-	-	5	-	-	-	-	-	-	-	-	-
		75	-	-	-	5	-	-	-	-	-	-	-	-	-
		50	-	-	-	5	-	-	-	-	-	-	-	-	-
		25	C	C	C	1	3	1	O.K.	2	O.K.	S	NO	S	NO
301-69-C	XR-261	90	C	C	C	0	3	3	O.K.	4	O.K.	D	-	D	-
		75	C	C	C	1	3	3	O.K.	3	O.K.	D	-	D	-
		50	C	C	C	0	3	3	O.K.	3	O.K.	D	-	D	-
		25	C	C	C	0	3	1	O.K.	1	O.K.	S	YES	S	NO
301-69-D	SR-111	90	-	-	-	5	-	-	-	-	-	-	-	-	-
		75	-	-	-	5	-	-	-	-	-	-	-	-	-
		50	-	-	-	5	-	-	-	-	-	-	-	-	-
		25	H	H	H	0	3	2	O.K.	2	O.K.	S	NO	S	NO
301-69-E	SR-98	90	C	C	C	0	4	4	O.K.	4	O.K.	D	-	D	-
		75	C	C	C	0	3	4	O.K.	4	O.K.	D	-	D	-
		50	H	H	H	0	4	4	O.K.	4	O.K.	D	-	D	-
		25	H	H	S	0	3	2	O.K.	2	O.K.	D	-	S	YES
301-69-F	SR-17	90	-	-	-	5	-	-	-	-	-	-	-	-	-
		75	-	-	-	5	-	-	-	-	-	-	-	-	-
		50	-	-	-	5	-	-	-	-	-	-	-	-	-
		25	H	H	S	0	3	2	O.K.	2	O.K.	S	NO	S	NO
301-69-G	ST-847	90	C	C	C	0	2	3	O.K.	3	O.K.	S	NO	D	-
		75	C	C	C	0	3	2	O.K.	3	O.K.	S	NO	S	NO
		50	C	C	C	0	3	0	O.K.	3	O.K.	D	-	S	NO
		25	H	C	H	0	3	o	O.K.	2	O.K.	S	YES	U	-

Table 11 (continued)

Epoxy Ester (Midland R-55) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min. @500F. Adh.	30 min. @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-69-H	DC-802	90	-	-	-	5	-	-	-	-	-	-	-	-	-
		75	-	-	-	5	-	-	-	-	-	-	-	-	-
		50	-	-	-	5	-	-	-	-	-	-	-	-	-
		25	H	C	H	0	3	2	O.K.	2	O.K.	S	NO	S	NO
301-69-K	DC-803	90	C	C	C	0	3	4	O.K.	4	O.K.	S	NO	D	-
		75	H	H	H	0	3	3	O.K.	4	O.K.	S	NO	D	-
		50	C	C	C	0	3	0	O.K.	1	O.K.	S	YES	S	NO
		25	H	C	H	0	3	1	O.K.	2	O.K.	S	NO	S	NO
301-69-L	DC-806A	90	C	C	C	0	3	3	O.K.	3	O.K.	D	-	D	-
		75	C	C	C	0	3	3	O.K.	2	O.K.	D	-	D	-
		50	C	C	C	0	3	1	O.K.	0	O.K.	S	NO	S	NO
		25	H	C	C	0	3	1	O.K.	1	O.K.	S	NO	S	NO
301-69-M	R-6-0031	90	C	C	C	0	3	4	O.K.	3	O.K.	D	-	D	-
		75	C	C	C	5	-	-	-	-	-	-	-	-	-
		50	I	-	-	-	-	-	-	-	-	-	-	-	-
		25	I	-	-	-	-	-	-	-	-	-	-	-	-
301-70-A	SR-119	90	-	-	-	5	-	-	-	-	-	-	-	-	-
		75	-	-	-	5	-	-	-	-	-	-	-	-	-
		50	-	-	-	5	-	-	-	-	-	-	-	-	-
		25	H	C	H	0	3	2	O.K.	2	O.K.	D	-	S	NO
301-70-B	ST-856	90	C	C	C	0	4	0	O.K.	1	O.K.	D	-	D	-
		75	H	H	H	0	3	1	O.K.	2	O.K.	D	-	D	-
		50	H	H	H	0	4	0	O.K.	2	O.K.	D	-	D	-
		25	H	H	H	0	3	0	O.K.	1	O.K.	D	-	S	NO

Table 11 (continued)

Epoxy Ester (Midland R-55) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility		30 day	Air Dried Film		30 min. @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
			Solution	Film	Stability	Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-70-C	XR-856	90	C	C	C	0	3	4	O.K.	4	O.K.	S	NO	D	-
		75	C	C	C	0	3	4	O.K.	4	O.K.	D	-	D	-
		50	C	C	C	1	3	2	O.K.	3	O.K.	D	-	D	-
		25	C	C	C	0	3	1	O.K.	2	O.K.	D	-	S	NO
301-70-D	DC-805	90	-	-	-	5	-	-	-	-	-	-	-	-	-
		75	H	H	H	2	3	3	O.K.	3	O.K.	S	NO	D	-
		50	C	C	C	1	3	3	O.K.	3	O.K.	S	YES	D	-
		25	H	C	S	0	3	1	O.K.	1	O.K.	S	NO	D	-
301-70-E	SR-32	90	-	-	-	5	-	-	-	-	-	-	-	-	-
		75	-	-	-	5	-	-	-	-	-	-	-	-	-
		50	-	-	-	5	-	-	-	-	-	-	-	-	-
		25	C	C	C	0	3	1	O.K.	1	O.K.	S	NO	S	NO
301-70-F	XR-630	90	C	C	C	0	3	4	O.K.	4	O.K.	D	-	D	-
		75	H	H	H	0	3	3	O.K.	3	O.K.	D	-	D	-
		50	H	H	H	0	3	4	O.K.	2	O.K.	D	-	S	NO
		25	H	H	H	0	3	0	O.K.	0	O.K.	D	-	S	NO
301-70-G	SR-82	90	C	C	C	1	3	4	O.K.	4	O.K.	D	-	D	-
		75	C	C	C	1	3	3	O.K.	4	O.K.	D	-	D	-
		50	C	C	C	1	3	3	O.K.	4	O.K.	D	-	S	NO
		25	C	C	C	0	3	1	O.K.	2	O.K.	S	NO	S	NO
301-70-H	DC-840	90	C	C	C	2	4	3	O.K.	4	O.K.	D	-	D	-
		75	C	C	C	2	4	3	O.K.	3	O.K.	D	-	D	-
		50	C	C	C	0	3	0	O.K.	3	O.K.	D	-	D	-
		25	C	C	C	0	3	2	O.K.	1	O.K.	S	NO	S	NO

Table 11 (continued)

Epoxy Ester (Midland R-55) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min. @500F. Adh.	30 min. @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-70-K	R-64	90	C	C	C	0	3	3	O.K.	3	O.K.	D	-	D	-
		75	C	C	C	0	4	3	O.K.	3	O.K.	D	-	D	-
		50	C	C	C	1	4	0	O.K.	1	O.K.	D	-	D	-
		25	H	C	H	0	3	1	O.K.	1	O.K.	S	NO	S	NO
301-70-L	SR-120	90	-	-	-	5	-	-	-	-	-	-	-	-	-
		75	-	-	-	5	-	-	-	-	-	-	-	-	-
		50	C	C	C	1	3	0	O.K.	0	O.K.	D	-	D	-
		25	H	C	H	0	3	2	O.K.	2	O.K.	D	-	S	NO
301-70-M	R-4471	90	C	C	C	0	3	3	O.K.	4	O.K.	D	-	D	-
		75	H	H	H	1	3	1	O.K.	3	O.K.	D	-	D	-
		50	C	C	C	0	3	3	O.K.	3	O.K.	D	-	D	-
		25	H	C	S	0	3	1	O.K.	1	O.K.	S	NO	D	-

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Compatibility

C - Compatible
H - Hazy
I - Incompatible

Stability

C - Compatible
H - Hazy
S - Stratified

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

J. Oxidizing Alkyd (Midland R-9) Modification of Silicone Resins

1. The compatibility of silicone resins and Midland R-9 was limited.

2. It was generally necessary to have 75% R-9 in a coating to obtain satisfactory dry.

3. Resistance to the test fluids was poor.

4. Heat resistance was good.

5. For details of Midland R-9 modifications of silicone resins, see Table 12.

K. Oxidizing Alkyd (Midland R-50) Modification of Silicone Resins

1. The compatibility of silicone resins and Midland R-50 was limited.

2. Resistance to the test fluids was slightly better than coatings containing Midland R-9, but was still unsatisfactory.

3. Heat resistance was good.

4. For details of Midland R-50 modification of silicone resins, see Table 13.

Table 12

Oxidizing Alkyd (Midland R-9) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min. @500F. Adh.	30 min. @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-75-B	SR-28	75	H	H	S	5	-	-	-	-	-	-	-	-	-
		50	C	C	C	3	3	3	O.K.	3	O.K.	S	NO	D	-
		25	C	C	C	2	3	1	O.K.	2	O.K.	D	-	D	-
301-75-C	XR-261	75	H	C	S	0	3	3	O.K.	3	O.K.	D	-	D	-
		50	C	C	C	0	3	3	O.K.	3	O.K.	S	NO	S	NO
		25	C	C	C	1	3	2	O.K.	3	O.K.	D	-	S	NO
301-75-D	SR-111	75	H	H	S	5	-	-	-	-	-	-	-	-	-
		50	H	H	S	5	-	-	-	-	-	-	-	-	-
		25	H	C	S	2	3	3	O.K.	4	O.K.	D	-	S	NO
301-75-E	SR-98	75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	I	S	-	-	-	-	-	-	-	-	-	-
		25	H	H	S	0	2	3	O.K.	4	O.K.	S	NO	S	NO
301-75-F	SR-17	75	H	H	S	5	-	-	-	-	-	-	-	-	-
		50	H	H	S	5	-	-	-	-	-	-	-	-	-
		25	H	C	S	2	3	4	O.K.	4	O.K.	D	-	D	-
301-75-G	ST-847	75	H	C	S	0	2	3	O.K.	3	O.K.	S	NO	S	NO
		50	H	C	S	0	2	0	O.K.	3	O.K.	D	-	S	NO
		25	H	C	S	0	2	1	O.K.	1	O.K.	D	-	S	NO
301-75-H	DC-802	75	H	H	S	5	-	-	-	-	-	-	-	-	-
		50	H	H	S	5	-	-	-	-	-	-	-	-	-
		25	H	C	S	0	3	2	O.K.	2	O.K.	D	-	S	NO

Table 12 (continued)

Oxidizing Alkyd (Midland R-9) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min. @500F. Adh.	30 min. @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-75-K	DC-803	75	H	C	S	0	4	4	O.K.	4	O.K.	D	-	D	-
		50	H	C	S	0	3	4	O.K.	4	O.K.	D	-	D	-
		25	H	C	S	0	3	2	O.K.	2	O.K.	D	-	S	NO
301-75-L	DC-806A	75	H	C	S	0	4	4	O.K.	3	O.K.	D	-	D	-
		50	H	H	S	0	3	3	O.K.	3	O.K.	D	-	D	-
		25	H	C	S	0	3	2	O.K.	3	O.K.	D	-	S	NO
301-75-M	R-6-0031	75	C	C	C	2	3	3	O.K.	3	O.K.	D	-	D	-
		50	H	C	S	2	3	3	O.K.	3	O.K.	S	NO	S	NO
		25	H	C	S	1	3	3	O.K.	3	O.K.	D	-	S	NO
301-76-A	SR-119	75	H	H	S	5	-	-	-	-	-	-	-	-	-
		50	H	C	H	5	-	-	-	-	-	-	-	-	-
		25	H	C	H	3	3	3	O.K.	3	O.K.	D	-	S	NO
301-76-B	ST-856	75	H	C	H	0	3	4	O.K.	3	O.K.	D	-	D	-
		50	H	C	H	0	2	2	O.K.	3	O.K.	D	-	S	NO
		25	C	C	H	0	2	3	O.K.	3	O.K.	D	-	S	NO
301-76-C	XR-856	75	H	C	S	0	3	4	O.K.	4	O.K.	D	-	D	-
		50	H	C	S	0	3	4	O.K.	3	O.K.	D	-	D	-
		25	H	C	S	0	3	2	O.K.	3	O.K.	D	-	S	NO
301-76-D	DC-805	75	H	H	S	5	-	-	-	-	-	-	-	-	-
		50	H	H	S	1	3	4	O.K.	4	O.K.	D	-	S	NO
		25	H	C	S	0	2	2	O.K.	2	O.K.	D	-	S	NO

Table 12 (continued)

Oxidizing Alkyd (Midland R-9) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min. @500F. Adh.	30 min. @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-76-E	SR-32	75	H	H	S	5	-	-	-	-	-	-	-	-	-
		50	H	H	S	5	-	-	-	-	-	-	-	-	-
		25	H	C	S	0	2	2	O.K.	2	O.K.	D	-	S	NO
301-76-F	XR-630	75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	H	S	0	2	3	O.K.	4	O.K.	S	NO	U	-
		25	H	H	S	1	2	3	O.K.	3	O.K.	D	-	U	-
301-76-G	SR-82	75	C	C	C	0	3	4	O.K.	3	O.K.	S	NO	D	-
		50	C	C	C	0	3	3	O.K.	3	O.K.	S	NO	S	NO
		25	C	C	C	0	3	3	O.K.	3	O.K.	D	-	S	NO
301-76-H	DC-840	75	C	C	C	0	3	4	O.K.	3	O.K.	D	-	D	-
		50	C	C	C	0	3	3	O.K.	3	O.K.	S	NO	S	NO
		25	C	C	C	0	3	3	O.K.	3	O.K.	D	-	S	NO
301-76-K	R-64	75	H	C	S	0	3	3	O.K.	3	O.K.	D	-	D	-
		50	H	C	H	0	3	3	O.K.	3	O.K.	S	NO	D	-
		25	C	C	C	0	3	3	O.K.	3	O.K.	D	-	S	NO
301-76-L	SR-120	75	H	H	S	5	-	-	-	-	-	-	-	-	-
		50	H	C	S	3	3	3	O.K.	3	O.K.	D	-	D	-
		25	H	C	S	1	3	2	O.K.	3	O.K.	D	-	S	NO
301-76-M	R-4471	75	H	C	S	0	3	4	O.K.	4	O.K.	D	-	D	-
		50	H	C	S	0	3	4	O.K.	4	O.K.	S	NO	S	NO
		25	H	C	S	0	2	3	O.K.	3	O.K.	S	NO	S	NO

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Compatibility

C - Compatible
H - Hazy
I - Incompatible

Stability

C - Compatible
H - Hazy
S - Stratified

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

Table 13

Oxidizing Alkyd (Midland R-50) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min. @500F. Adh.	30 min. @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-77-B	SR-28	75	C	C	C	5	-	-	-	-	-	-	-	-	-
		50	C	C	C	2	3	1	O.K.	2	O.K.	S	NO	S	YES
		25	C	C	C	0	3	2	O.K.	3	O.K.	S	NO	S	NO
301-77-C	XR-261	75	H	C	H	0	1	2	O.K.	2	O.K.	D	-	S	NO
		50	H	C	H	0	2	1	O.K.	2	O.K.	S	NO	S	NO
		25	H	C	H	0	3	1	O.K.	2	O.K.	S	NO	S	NO
301-77-D	SR-111	75	H	H	S	0	2	2	O.K.	3	O.K.	S	NO	S	NO
		50	H	C	S	0	2	1	B	3	O.K.	D	-	D	-
		25	I	-	-	-	-	-	-	-	-	-	-	-	-
301-77-E	SR-98	75	H	H	S	0	3	3	O.K.	4	O.K.	D	-	D	-
		50	H	I	S	-	-	-	-	-	-	-	-	-	-
		25	H	H	S	0	3	1	O.K.	2	O.K.	S	NO	D	-
301-77-F	SR-17	75	H	H	S	5	-	-	-	-	-	-	-	-	-
		50	H	C	S	0	3	1	O.K.	3	O.K.	S	NO	S	NO
		25	H	C	S	0	2	1	O.K.	3	O.K.	S	NO	S	NO
301-77-G	ST-847	75	H	C	H	0	1	2	O.K.	3	O.K.	S	NO	S	YES
		50	H	C	S	0	2	2	O.K.	3	O.K.	S	NO	S	YES
		25	H	C	S	0	3	2	O.K.	2	O.K.	S	NO	D	-
301-77-H	DC-802	75	H	C	S	3	2	1	O.K.	4	O.K.	D	-	D	-
		50	H	C	S	0	2	0	O.K.	1	O.K.	S	NO	D	-
		25	H	C	S	0	2	0	O.K.	1	O.K.	S	NO	S	NO

Table 13 (continued)

Oxidizing Alkyd (Midland R-50) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility		30 day	Air Dried Film		30 min. @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
			Solution	Film	Stability	Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-77-K	DC-803	75	H	C	S	0	1	3	O.K.	3	O.K.	D	-	D	-
		50	H	H	S	0	2	2	O.K.	2	O.K.	S	NO	D	-
		25	H	C	S	0	2	1	O.K.	2	O.K.	S	NO	S	NO
301-77-L	DC-806A	75	H	C	S	0	1	1	O.K.	2	O.K.	D	-	D	-
		50	H	H	S	0	1	0	O.K.	1	O.K.	S	NO	S	NO
		25	H	C	S	0	2	1	O.K.	2	O.K.	S	NO	S	NO
301-77-M	R-6-0031	75	H	I	-	-	-	-	-	-	-	-	-	-	-
		50	H	I	-	-	-	-	-	-	-	-	-	-	-
		25	I	-	-	-	-	-	-	-	-	-	-	-	-
301-78-A	SR-119	75	C	C	C	3	2	3	O.K.	4	O.K.	D	-	D	-
		50	H	C	H	1	1	2	O.K.	3	O.K.	D	-	D	-
		25	H	C	H	0	3	2	O.K.	2	O.K.	D	-	D	-
301-78-B	ST-856	75	H	H	S	0	3	0	B	1	O.K.	D	-	D	-
		50	H	H	S	0	1	1	O.K.	1	O.K.	D	-	D	-
		25	H	I	S	-	-	-	-	-	-	-	-	-	-
301-78-C	XR-856	75	H	H	S	0	2	2	O.K.	3	O.K.	D	-	D	-
		50	H	C	S	0	1	1	O.K.	2	O.K.	D	-	S	NO
		25	H	C	S	0	3	1	O.K.	1	O.K.	D	-	D	-
301-78-D	DC-805	75	H	C	S	3	1	1	O.K.	3	O.K.	D	-	D	-
		50	H	I	S	1	1	1	B	3	B	D	-	D	-
		25	H	H	S	0	1	1	O.K.	2	O.K.	S	NO	S	NO

Table 13 (continued)

Oxidizing Alkyd (Midland R-50) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility		30 day Stability	Air Dried Film		30 min. @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
			Solution	Film		Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-78-E	SR-32	75	H	H	S	3	1	3	O.K.	3	O.K.	D	-	D	-
		50	H	I	S	-	-	-	-	-	-	-	-	-	-
		25	H	H	S	0	3	1	O.K.	2	O.K.	D	-	S	NO
301-78-F	XR-630	75	H	H	S	0	1	1	O.K.	4	O.K.	D	-	S	NO
		50	H	I	S	-	-	-	-	-	-	-	-	-	-
		25	H	H	S	0	3	1	O.K.	0	O.K.	D	-	S	NO
301-78-G	SR-82	75	C	H	C	0	1	2	O.K.	2	O.K.	S	YES	D	-
		50	C	H	C	0	1	2	O.K.	3	O.K.	S	YES	S	NO
		25	C	C	C	0	2	1	O.K.	1	O.K.	S	YES	S	NO
301-78-H	DC-840	75	C	C	C	0	1	1	O.K.	3	O.K.	D	-	D	-
		50	C	C	C	0	2	2	O.K.	1	O.K.	D	-	S	NO
		25	C	C	C	0	2	1	O.K.	1	O.K.	S	NO	S	NO
301-78-K	R-64	75	C	C	C	0	1	1	O.K.	2	O.K.	S	NO	D	-
		50	H	H	S	0	3	1	O.K.	2	O.K.	D	-	D	-
		25	H	C	H	0	3	0	O.K.	2	O.K.	S	NO	S	NO
301-78-L	SR-120	75	H	C	S	2	1	2	O.K.	2	O.K.	D	-	D	-
		50	H	C	S	0	2	2	O.K.	3	O.K.	D	-	D	-
		25	H	C	S	0	3	2	O.K.	3	O.K.	D	-	S	NO
301-78-M	R-4471	75	H	H	S	0	0	1	B	4	O.K.	D	-	D	-
		50	H	I	S	-	-	-	-	-	-	-	-	-	-
		25	H	C	S	0	2	1	O.K.	2	O.K.	S	NO	S	NO

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Compatibility

C - Compatible
H - Hazy
I - Incompatible

Stability

C - Compatible
H - Hazy
S - Stratified

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

L. Phenolic (Bakelite BRS-2600) Modification of Silicone Resins

1. The compatibility of BRS-2600 and silicone resins was poor.

2. Coatings containing 75% BRS-2600 had excellent resistance to the test fluids.

3. Most of these coatings blistered when tested at 500°F.

4. For details of Bakelite BRS-2600 modifications of silicone resins, see Table 14.

M. Butadiene Acrylonitrile Modification of Silicone Resins

1. The compatibility of Paracril CV and silicone resins was limited.

2. Resistance to the test fluids was poor.

3. Some of the coatings containing 75% Paracril CV decomposed at 500°F.

4. For details of Paracril CV modifications of silicone resins, see Table 15.

Table 14

Phenolic (Bakelite BRS-2600) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min. @500F. Adh.	30 min. @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-81-A	SR-28	75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	I	S	-	-	-	-	-	-	-	-	-	-
		25	H	H	S	0	4	3	B	3	B	U	-	U	-
301-81-B	XR-261	75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	I	S	-	-	-	-	-	-	-	-	-	-
		25	H	H	S	0	3	3	B	3	B	U	-	U	-
301-81-C	SR-111	75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	I	S	-	-	-	-	-	-	-	-	-	-
		25	H	H	S	1	5	5	B	4	B	U	-	U	-
301-81-D	SR-98	75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	I	S	-	-	-	-	-	-	-	-	-	-
		25	H	H	H	0	3	3	B	4	B	U	-	U	-
301-81-E	SR-17	75	H	I	S	4	-	-	-	-	-	-	-	-	-
		50	H	I	S	4	-	-	-	-	-	-	-	-	-
		25	H	H	S	1	3	4	B	4	B	U	-	U	-
301-81-F	ST-847	75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	H	H	1	2	2	O.K.	2	O.K.	D	-	D	-
		25	H	H	S	0	4	4	B	4	B	U	-	U	-
301-81-G	DC-802	75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	I	S	-	-	-	-	-	-	-	-	-	-
		25	H	H	S	0	5	4	B	4	B	U	-	U	-

Table 14 (continued)

Phenolic (Bakelite BRS-2600) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min. @500F. Adh.	30 min. @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-81-H	DC-803	75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	I	S	-	-	-	-	-	-	-	-	-	-
		25	H	H	S	O	5	4	B	4	B	U	-	U	-
301-81-K	DC-806A	75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	H	S	O	3	3	O.K.	3	O.K.	D	-	D	-
		25	H	H	S	O	3	4	B	4	B	U	-	U	-
301-81-L	R-6-0031	75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	I	S	2	1	3	O.K.	3	O.K.	S	NO	D	-
		25	C	H	C	O	4	3	O.K.	3	O.K.	U	-	U	-
301-81-M	SR-119	75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	I	S	-	-	-	-	-	-	-	-	-	-
		25	H	H	S	O	5	3	B	3	B	U	-	U	-
301-82-A	ST-856	75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	H	S	O	1	1	O.K.	3	O.K.	D	-	D	-
		25	H	H	H	O	5	3	B	3	B	U	-	U	-
301-82-B	XR-856	75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	H	S	O	5	4	B	4	B	D	-	D	-
		25	H	H	S	O	5	3	O.K.	3	O.K.	U	-	U	-
301-82-C	DC-805	75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	H	S	O	5	4	B	4	B	D	-	D	-
		25	H	H	S	O	4	3	O.K.	3	O.K.	U	-	U	-

Table 14 (continued)

Phenolic (Bakelite BRS-2600) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min. @500F. Adh.	30 min. @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-82-D	SR-32	75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	H	S	5	-	-	-	-	-	-	-	-	-
		25	H	H	S	1	5	4	B	4	B	U	-	U	-
301-82-E	XR-630	75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	H	S	5	-	-	-	-	-	-	-	-	-
		25	H	I	S	-	-	-	-	-	-	-	-	-	-
301-82-F	SR-82	75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	I	S	-	-	-	-	-	-	-	-	-	-
		25	H	H	S	0	3	4	B	4	B	U	-	U	-
301-82-G	DC-840	75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	I	S	-	-	-	-	-	-	-	-	-	-
		25	H	H	S	0	5	4	B	4	B	U	-	U	-
301-82-H	R-64	75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	I	-	-	-	-	-	-	-	-	-	-	-
		25	H	H	S	0	5	4	B	4	B	U	-	U	-
301-82-K	SR-120	75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	I	S	-	-	-	-	-	-	-	-	-	-
		25	H	H	S	0	5	3	O.K.	3	O.K.	U	-	U	-
301-82-L	R-4471	75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	I	S	-	-	-	-	-	-	-	-	-	-
		25	H	H	S	0	4	3	B	4	B	U	-	U	-

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Compatibility

C - Compatible
H - Hazy
I - Incompatible

Stability

C - Compatible
H - Hazy
S - Stratified

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

Table 15

Butadiene Acrylonitrile (Paracril CV) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min. @500F. Adh.	30 min. @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-88-A	SR-28	75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	H	3	5	5	O.K.	5	O.K.	D	-	D	-
		25	H	C	H	2	5	5	O.K.	DECOMPOSED		D	-	D	-
301-88-B	XR-261	75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	H	0	5	5	O.K.	5	O.K.	D	-	D	-
		25	H	C	H	0	5	5	O.K.	5	O.K.	D	-	D	-
301-88-C	SR-111	75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	H	H	4	4	4	O.K.	4	O.K.	D	-	D	-
		25	I	-	-	-	-	-	-	-	-	-	-	-	-
301-88-D	SR-98	75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	H	S	0	5	5	O.K.	5	O.K.	D	-	D	-
		25	H	C	H	0	5	5	O.K.	5	O.K.	D	-	D	-
301-88-E	SR-17	75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	H	S	3	5	5	O.K.	5	O.K.	D	-	D	-
		25	H	C	H	1	5	5	O.K.	5	O.K.	D	-	D	-
301-88-F	ST-847	75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	H	0	5	4	O.K.	4	O.K.	D	-	D	-
		25	H	C	H	0	5	5	O.K.	5	O.K.	D	-	D	-
301-88-G	DC-802	75	H	H	S	4	5	4	O.K.	5	O.K.	D	-	D	-
		50	H	C	H	3	5	4	O.K.	4	O.K.	D	-	D	-
		25	H	C	H	3	5	5	O.K.	5	O.K.	D	-	D	-

Table 15 (continued)

Butadiene Acrylonitrile (Paracril CV) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min. @500F. Adh.	30 min. @500F. Film Integrity	2 hr. @ 500F. Adh.	2 hr. @ 500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-88-H	DC-803	75	H	H	S	0	4	4	O.K.	5	O.K.	D	-	D	-
		50	H	C	H	0	5	5	O.K.	5	O.K.	D	-	D	-
		25	H	C	H	0	5	5	O.K.	5	O.K.	D	-	D	-
301-88-K	DC-806A	75	H	H	H	0	4	4	O.K.	5	O.K.	D	-	D	-
		50	H	C	H	0	5	5	O.K.	5	O.K.	D	-	D	-
		25	H	C	H	0	5	5	O.K.	5	O.K.	D	-	D	-
301-88-L	R-6-0031	75	H	H	S	1	4	4	O.K.	4	O.K.	D	-	D	-
		50	H	C	S	0	3	5	O.K.	5	O.K.	D	-	D	-
		25	H	C	H	0	3	5	O.K.	5	O.K.	D	-	D	-
301-88-M	SR-119	75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	H	3	3	5	O.K.	5	O.K.	D	-	D	-
		25	H	C	H	2	4	5	O.K.	5	O.K.	D	-	D	-
301-89-A	ST-856	75	H	H	S	0	3	3	O.K.	5	O.K.	D	-	D	-
		50	H	C	S	0	3	3	O.K.	5	O.K.	D	-	D	-
		25	H	C	H	0	4	5	O.K.	5	O.K.	D	-	D	-
301-89-B	XR-856	75	H	H	S	0	3	4	O.K.	5	O.K.	D	-	D	-
		50	H	C	S	0	3	5	O.K.	5	O.K.	D	-	D	-
		25	H	C	H	0	4	5	O.K.	5	O.K.	D	-	D	-
301-89-C	DC-805	75	H	I	S	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	0	5	4	O.K.	5	O.K.	D	-	D	-
		25	H	C	S	0	5	5	O.K.	5	O.K.	D	-	D	-

Table 15 (continued)

Butadiene Acrylonitrile (Paracril CV) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility		30 day	Air Dried Film		30 min. @500F.		2 hr. @ 500F.		MIL-S-3136 Fluid		Lubricant	
			Solution	Film	Stability	Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-89-D	SR-32	75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	I	S	-	-	-	-	-	-	-	-	-	-
		25	H	C	H	0	5	5	O.K.	5	O.K.	D	-	D	-
301-89-E	XR-630	75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	H	S	2	5	5	O.K.	5	O.K.	D	-	D	-
		25	H	C	H	0	5	5	O.K.	5	O.K.	D	-	D	-
301-89-F	SR-82	75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	H	0	5	5	O.K.	5	O.K.	D	-	D	-
		25	H	C	H	0	5	5	O.K.	DECOMPOSED		D	-	D	-
301-89-G	DC-840	75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	0	5	5	O.K.	5	O.K.	D	-	D	-
		25	H	C	H	0	5	5	O.K.	DECOMPOSED		D	-	D	-
301-89-H	R-64	75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	H	0	5	5	O.K.	5	O.K.	D	-	D	-
		25	H	C	H	0	5	5	O.K.	5	O.K.	D	-	D	-
301-89-K	SR-120	75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	I	S	-	-	-	-	-	-	-	-	-	-
		25	H	C	H	1	4	3	O.K.	5	O.K.	D	-	D	-
301-89-L	R-4471	75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	H	C	S	1	5	5	O.K.	5	O.K.	D	-	D	-
		25	H	C	H	1	5	5	O.K.	DECOMPOSED		D	-	D	-

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Compatibility

C - Compatible
H - Hazy
I - Incompatible

Stability

C - Compatible
H - Hazy
S - Stratified

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

N. <u>Natural Fossil Resin (RBH 510) Modification of Silicone Resins</u>

1. The compatibility of RBH 510 and silicone resins was fairly good.

2. Resistance to the diester lubricant was quite good but resistance to MIL-S-3136 fluid was poor.

3. Heat resistance of coatings containing RBH 510 was poor. Flaking, blistering, and decomposition were all noted.

4. For details of RBH 510 modifications of silicone resins, see Table 16.

Table 16

Natural Fossil Resin (RBH 510) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility		30 day	Air Dried Film		30 min. @500 F.		2 hr. @500 F.		MIL-S-3136 Fluid		Lubricant	
			Solution	Film	Stability	Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-92-A	SR-28	75	I	-	-	-	-	-	-	-	-	-	-	-	-
		50	C	C	C	O	5	5	N.G.	4	O.K.	D	-	D	-
		25	C	C	C	O	5	5	N.G.	5	N.G.	D	-	U	-
301-92-B	XR-261	75	C	C	C	O	4	5	O.K.	4	O.K.	D	-	D	-
		50	C	C	C	O	5	5	N.G.	5	N.G.	D	-	U	-
		25	C	C	C	O	4	5	N.G.	5	N.G.	D	-	U	-
301-92-C	SR-111	75	H	H	H	3	4	4	O.K.	4	O.K.	D	-	D	-
		50	H	H	H	3	4	5	N.G.	5	N.G.	D	-	D	-
		25	H	C	H	O	5	5	N.G.	5	N.G.	D	-	U	-
301-92-D	SR-98	75	H	H	H	O	5	5	N.G.	5	N.G.	D	-	D	-
		50	H	H	H	O	4	5	N.G.	5	N.G.	D	-	D	-
		25	C	C	C	O	5	5	N.G.	5	N.G.	D	-	U	-
301-92-E	SR-17	75	C	C	C	3	3	4	O.K.	4	O.K.	D	-	D	-
		50	C	C	C	O	5	5	N.G.	5	N.G.	D	-	U	-
		25	C	C	C	O	4	5	N.G.	5	N.G.	D	-	U	-
301-92-F	ST-847	75	H	C	H	O	3	3	O.K.	3	O.K.	D	-	D	-
		50	H	H	H	O	3	2	O.K.	DECOMPOSED		D	-	D	-
		25	C	C	C	O	5	5	N.G.	5	N.G.	D	-	U	-
301-92-G	DC-802	75	C	C	C	O	5	4	O.K.	4	O.K.	D	-	D	-
		50	C	C	C	O	4	5	N.G.	4	O.K.	D	-	U	-
		25	C	C	C	O	5	5	N.G.	5	N.G.	D	-	U	-

Table 16 (continued)

Natural Fossil Resin (RBH 510) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min. @500F. Adh.	30 min. @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-92-H	DC-803	75	C	C	C	0	5	4	O.K.	4	O.K.	D	-	D	-
		50	C	C	C	0	4	5	N.G.	5	N.G.	D	-	U	-
		25	C	C	C	0	5	5	N.G.	5	N.G.	D	-	U	-
301-92-K	DC-806A	75	H	C	H	0	4	4	O.K.	3	O.K.	D	-	D	-
		50	H	H	H	0	5	5	N.G.	5	N.G.	D	-	D	-
		25	H	C	H	0	5	5	N.G.	5	N.G.	D	-	U	-
301-92-L	R-6-0031	75	H	C	H	1	3	3	O.K.	2	O.K.	D	-	D	-
		50	I	-	-	-	-	-	-	-	-	-	-	-	-
		25	I	-	-	-	-	-	-	-	-	-	-	-	-
301-93-A	SR-119	75	H	H	S	4	4	3	O.K.	4	O.K.	D	-	D	-
		50	H	I	S	-	-	-	-	-	-	-	-	-	-
		25	H	C	H	0	5	5	N.G.	5	N.G.	D	-	U	-
301-93-B	ST-856	75	C	C	C	0	4	3	O.K.	2	O.K.	D	-	D	-
		50	C	C	C	0	4	5	N.G.	3	N.G.	D	-	U	-
		25	C	C	C	0	5	5	N.G.	5	N.G.	D	-	U	-
301-93-C	XR-856	75	H	H	H	1	4	4	O.K.	3	O.K.	D	-	D	-
		50	H	H	H	0	4	5	N.G.	4	B	D	-	D	-
		25	H	C	H	0	4	5	N.G.	4	B	D	-	U	-
301-93-D	DC-805	75	H	C	H	2	4	4	O.K.	3	O.K.	D	-	D	-
		50	H	H	H	0	5	5	N.G.	4	N.G.	D	-	D	-
		25	H	C	H	0	5	5	N.G.	5	N.G.	D	-	U	-

Table 16 (continued)

Natural Fossil Resin (RBH 510) Modification of Silicone Resins

Vehicle Code	Silicone	%	Compatibility Solution	Compatibility Film	30 day Stability	Air Dried Film Dry	Air Dried Film Adhesion	30 min. @500F. Adh.	30 min. @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-93-E	SR-32	75	H	C	H	3	3	3	O.K.	1	O.K.	D	-	D	-
		50	H	I	S	-	-	-	-	-	-	-	-	-	-
		25	H	C	S	0	5	5	N.G.	5	N.G.	D	-	U	-
301-93-F	XR-630	75	H	H	S	0	4	4	O.K.	3	O.K.	D	-	D	-
		50	H	I	S	-	-	-	-	-	-	-	-	-	-
		25	H	C	S	0	5	5	N.G.	5	N.G.	D	-	U	-
301-93-G	SR-82	75	H	C	H	0	4	5	N.G.	4	O.K.	D	-	D	-
		50	H	H	H	1	5	5	N.G.	5	N.G.	D	-	D	-
		25	H	C	H	0	5	5	N.G.	5	N.G.	D	-	D	-
301-93-H	DC-840	75	H	C	H	0	4	5	N.G.	3	O.K.	D	-	D	-
		50	H	H	H	0	4	5	N.G.	5	N.G.	D	-	D	-
		25	H	C	H	0	5	5	N.G.	5	N.G.	D	-	U	-
301-93-K	R-64	75	C	C	C	0	3	5	N.G.	4	O.K.	D	-	D	-
		50	C	C	C	0	4	5	N.G.	5	N.G.	D	-	D	-
		25	C	C	C	0	4	5	N.G.	5	N.G.	D	-	U	-
301-93-L	SR-120	75	H	C	S	3	3	3	O.K.	1	B	D	-	D	-
		50	H	I	S	-	-	-	-	-	-	-	-	-	-
		25	H	C	S	0	4	5	N.G.	5	N.G.	D	-	U	-
301-93-M	R-4471	75	H	H	S	2	3	5	N.G.	3	O.K.	D	-	D	-
		50	H	I	S	0	4	5	N.G.	5	N.G.	D	-	D	-
		25	H	C	H	0	4	5	N.G.	5	N.G.	D	-	D	-

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Compatiblity

C - Compatible
H - Hazy
I - Incompatible

Stability

C - Compatible
H - Hazy
S - Stratified

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

O. Epoxy Resin Systems

1. Coatings containing Epon 828 were generally unsatisfactory. Many Epon 828 coatings would not properly cure and many others had a tendency to "crawl" and create an appearance of incompatibility.

2. With the exception of Versamid 100, the polyamides successfully cured the epoxies and were judged to be about equivalent in performance. Coatings containing Versamid 100 were sensitive to the MIL-S-3136 fluid but this was probably because Versamid 100 is the slowest reacting polyamide.

3. Coatings containing 10% and 25% polyamide (depending on the epoxy used) had the best resistance to the test fluids and had the best over-all film properties.

4. The solid epoxies (Epons 1001, 1004, 1007, and 1009) seemed to be about equal in performance with Epon 1009 possibly having slightly superior heat resistance.

5. The silicone epoxy copolymers (Dow Corning XR-6-0000 and Midland X-4209) had no better heat resistance than the unmodified epoxies and were slightly poorer than the unmodified epoxies in resistance to the test fluids.

6. Dow Corning Z-6020 amino silane appeared to be an effective curing agent for epoxies but had little effect on the high temperature properties of the epoxies which were quite good to begin with.

7. The epoxy novolacs (Dow 2638.1 and Dow 2638.3) were all extremely brittle, regardless of the curing agent used.

8. Shell H-1 and H-2 curing agents seemed to be worthwhile catalysts with Epon 1001 and the silicone-epoxy copolymers. With Epon 1007 and Epon 1009, however, a large number of eyeholes appear in the coatings after the 500°F. heat exposure. These eyeholes were not present before the heat test. H-1 seemed to be slightly superior in performance to H-2.

9. Details of epoxy resin systems may be found in Tables 17-26.

Table 17

Epoxy-Polyamide (Versamid 100) Resin Systems

Vehicle Code	Epoxy or Epoxy Co-Polymer	%	Film Compatibility	Air Dried Film		30 min. @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
				Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-26-E	Epon 828	90	I	5	5	-	-	-	-	-	-	-	-
		75	I	4	4	-	-	-	-	-	-	-	-
		50	I	4	4	-	-	-	-	-	-	-	-
		25	C	4	3	2	O.K.	3	O.K.	S	NO	U	-
301-26-D	Epon 1001	90	C	2	3	1	O.K.	1	O.K.	S	NO	S	YES
		75	C	2	3	0	O.K.	3	O.K.	S	NO	S	YES
		50	C	3	1	1	O.K.	2	O.K.	S	YES	U	-
		25	C	2	2	0	O.K.	2	O.K.	S	NO	U	-
301-26-A	Epon 1004	90	C	1	2	1	O.K.	2	O.K.	S	YES	S	NO
		75	C	1	3	1	O.K.	3	O.K.	S	NO	S	NO
		50	C	1	3	2	O.K.	2	O.K.	S	NO	S	NO
		25	C	0	3	1	O.K.	2	O.K.	S	NO	U	-
301-26-B	Epon 1007	90	C	0	3	2	O.K.	3	O.K.	S	YES	U	-
		75	C	2	4	2	O.K.	2	O.K.	S	NO	U	-
		50	C	1	4	2	O.K.	1	O.K.	S	NO	S	NO
		25	C	4	4	2	O.K.	2	O.K.	S	NO	S	NO
301-26-C	Epon 1009	90	C	0	3	0	O.K.	1	O.K.	S	NO	U	-
		75	C	0	3	0	O.K.	1	O.K.	S	NO	S	NO
		50	H	3	4	1	O.K.	2	O.K.	S	NO	S	NO
		25	C	4	4	1	O.K.	3	O.K.	S	YES	S	NO

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Compatibility

C - Compatible
H - Hazy
I - Incompatible

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

Table 18

Epoxy-Polyamide (Versamid 115) Resin Systems

Vehicle Code	Epoxy or Epoxy Co-Polymer	%	Film Compatibility	Air Dried Film		30 min. @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
				Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-13-E	Epon 828	90	I	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-
		50	I	-	-	-	-	-	-	-	-	-	-
		25	I	-	-	-	-	-	-	-	-	-	-
301-13-D	Epon 1001	90	C	1	3	0	O.K.	2	O.K.	S	NO	S	NO
		75	C	0	1	1	O.K.	2	O.K.	U	-	U	-
		50	C	0	2	1	O.K.	3	O.K.	S	YES	U	-
		25	C	3	3	0	O.K.	3	O.K.	S	NO	U	-
301-13-A	Epon 1004	90	C	0	5	1	O.K.	3	O.K.	U	-	U	-
		75	C	0	5	2	O.K.	4	O.K.	U	-	U	-
		50	C	1	4	1	O.K.	1	O.K.	S	NO	U	-
		25	C	2	4	2	B	4	B	S	NO	U	-
301-13-B	Epon 1007	90	C	1	3	1	O.K.	3	O.K.	U	-	U	-
		75	C	0	3	2	O.K.	2	O.K.	U	-	U	-
		50	C	1	4	3	B	1	O.K.	S	NO	U	-
		25	C	2	5	3	B	3	B	S	NO	S	NO
301-13-C	Epon 1009	90	C	1	5	3	O.K.	1	O.K.	U	-	U	-
		75	C	0	4	2	O.K.	2	O.K.	S	YES	U	-
		50	C	1	4	2	B	0	B	S	NO	U	-
		25	C	2	5	3	B	2	B	S	NO	S	NO

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Compatibility

C - Compatible
H - Hazy
I - Incompatible

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

Table 19

Epoxy-Polyamide (Versamid 125) Resin Systems

Vehicle Code	Epoxy or Epoxy Co-Polymer	%	Film Compatibility	Air Dried Film		30 min. @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
				Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-13-L	Epon 828	90	I	5	5	-	-	-	-	-	-	-	-
		75	H	4	4	0	O.K.	0	O.K.	S	YES	U	-
		50	C	2	1	2	O.K.	1	O.K.	U	-	U	-
		25	C	3	4	0	O.K.	0	O.K.	S	NO	U	-
301-13-K	Epon 1001	90	C	0	3	0	O.K.	2	O.K.	U	-	U	-
		75	C	0	1	1	O.K.	3	O.K.	U	-	U	-
		50	C	0	2	0	O.K.	0	O.K.	U	-	U	-
		25	C	5	5	-	-	-	-	-	-	-	-
301-13-F	Epon 1004	90	C	0	3	1	O.K.	2	O.K.	U	-	U	-
		75	C	0	3	1	O.K.	2	O.K.	U	-	U	-
		50	H	0	3	1	O.K.	1	O.K.	S	NO	U	-
		25	C	5	-	-	-	-	-	-	-	-	-
301-13-G	Epon 1007	90	C	0	2	1	O.K.	2	O.K.	U	-	U	-
		75	C	0	3	1	O.K.	3	O.K.	S	NO	U	-
		50	C	2	4	2	O.K.	3	O.K.	S	NO	U	-
		25	H	5	-	-	-	-	-	-	-	-	-
301-13-H	Epon 1009	90	C	0	2	0	O.K.	1	O.K.	U	-	U	-
		75	C	0	2	0	O.K.	1	O.K.	S	NO	U	-
		50	C	2	4	1	O.K.	1	O.K.	S	NO	U	-
		25	H	4	5	-	-	-	-	-	-	-	-

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Compatibility

C - Compatible
H - Hazy
I - Incompatible

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties.
No - Did not recover original properties.

Table 20

Epoxy-Polyamide (Versamid 140) Resin Systems

Vehicle Code	Epoxy or Epoxy Co-Polymer	%	Film Compatibility	Air Dried Film		30 min. @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
				Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-26-L	Epon 828	90	C	4	4	-	-	-	-	-	-	-	-
		75	C	3	0	0	O.K.	0	O.K.	U	-	U	-
		50	C	3	0	0	O.K.	0	O.K.	U	-	U	-
		25	H	4	4	-	-	-	-	-	-	-	-
301-26-K	Epon 1001	90	C	2	3	1	O.K.	1	O.K.	U	-	U	-
		75	C	1	2	0	O.K.	1	O.K.	U	-	U	-
		50	C	3	2	1	O.K.	1	O.K.	S	NO	S	YES
		25	C	4	4	-	-	-	-	-	-	-	-
301-26-F	Epon 1004	90	C	1	3	0	O.K.	2	O.K.	U	-	U	-
		75	C	0	3	1	O.K.	1	O.K.	U	-	U	-
		50	C	5	4	-	-	-	-	-	-	-	-
		25	H	5	5	-	-	-	-	-	-	-	-
301-26-G	Epon 1007	90	C	0	3	1	O.K.	3	O.K.	U	-	U	-
		75	C	0	2	1	O.K.	3	O.K.	U	-	U	-
		50	H	5	5	-	-	-	-	-	-	-	-
		25	I	5	5	-	-	-	-	-	-	-	-
301-26-H	Epon 1009	90	C	1	1	1	O.K.	1	O.K.	U	-	U	-
		75	C	0	3	1	O.K.	1	O.K.	U	-	U	-
		50	H	5	5	-	-	-	-	-	-	-	-
		25	I	5	5	-	-	-	-	-	-	-	-
301-63-G	Dow Corning XR-6-0000	90	C	0	3	2	O.K.	3	O.K.	S	NO	U	-
		75	C	0	2	1	O.K.	1	O.K.	S	YES	U	-
301-63-L	Midland X-4209	90	C	0	1	2	O.K.	3	O.K.	S	NO	U	-
		75	C	0	1	1	O.K.	2	O.K.	S	YES	U	-

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Compatibility

C - Compatible
H - Hazy
I - Incompatible

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

Table 21

Epoxy-Polyamide (Genamid 250) Resin Systems

Vehicle Code	Epoxy or Epoxy Co-Polymer	%	Film Compatibility	Air Dried Film Dry	Air Dried Film Adhesion	30 min. @500F. Adh.	30 min. @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S3136 Fluid 4 hr. Immers.	MIL-S3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-54-E	Epon 828	90	-	5	-	-	-	-	-	-	-	-	-
		75	C	3	0	1	O.K.	2	O.K.	S	NO	U	-
		50	C	4	3	3	O.K.	3	O.K.	S	NO	U	-
		25	-	5	-	-	-	-	-	-	-	-	-
301-54-D	Epon 1001	90	C	0	1	0	O.K.	2	O.K.	S	NO	U	-
		75	C	0	2	2	O.K.	3	O.K.	U	-	U	-
		50	-	5	-	-	-	-	-	-	-	-	-
		25	-	5	-	-	-	-	-	-	-	-	-
301-54-A	Epon 1004	90	C	0	3	3	O.K.	3	O.K.	U	-	U	-
		75	C	0	3	3	O.K.	2	O.K.	U	-	U	-
		50	-	5	-	-	-	-	-	-	-	-	-
		25	-	5	-	-	-	-	-	-	-	-	-
301-54-B	Epon 1007	90	C	0	3	3	O.K.	2	O.K.	U	-	U	-
		75	C	0	3	2	O.K.	3	O.K.	S	NO	U	-
		50	-	5	-	-	-	-	-	-	-	-	-
		25	-	5	-	-	-	-	-	-	-	-	-
301-54-C	Epon 1009	90	C	0	3	0	O.K.	0	O.K.	U	-	U	-
		75	C	0	3	2	O.K.	0	O.K.	S	NO	U	-
		50	-	5	-	-	-	-	-	-	-	-	-
		25	-	5	-	-	-	-	-	-	-	-	-
301-63-F	Dow Corning XR-6-0000	90	C	0	3	2	O.K.	3	O.K.	S	NO	U	-
		75	C	0	3	3	O.K.	3	O.K.	S	NO	U	-
301-63-K	Midland X-4209	90	C	0	3	0	O.K.	1	O.K.	S	YES	U	-
		75	H	3	3	2	O.K.	3	O.K.	S	NO	S	NO

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Compatibility

C - Compatible
H - Hazy
I - Incompatible

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

Table 22

Epoxy-Polyamide (Genamid 310) Resin Systems

Vehicle Code	Epoxy or Epoxy Co-Polymer	%	Film Compatibility	Air Dried Film		30 min. @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
				Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-54-L	Epon 828	90	C	0	0	0	O.K.	0	O.K.	D	-	S	NO
		75	C	0	0	0	O.K.	0	O.K.	D	-	U	-
		50	-	5	-	-	-	-	-	-	-	-	-
		25	-	5	-	-	-	-	-	-	-	-	-
301-54-K	Epon 1001	90	C	0	0	1	O.K.	2	O.K.	S	NO	S	YES
		75	C	0	1	1	O.K.	2	O.K.	U	-	U	-
		50	-	5	-	-	-	-	-	-	-	-	-
		25	-	5	-	-	-	-	-	-	-	-	-
301-54-F	Epon 1004	90	C	0	1	1	O.K.	3	O.K.	U	-	U	-
		75	C	0	1	1	O.K.	3	O.K.	S	YES	U	-
		50	-	5	-	-	-	-	-	-	-	-	-
		25	-	5	-	-	-	-	-	-	-	-	-
301-54-G	Epon 1007	90	C	0	0	1	O.K.	3	O.K.	U	-	U	-
		75	C	0	1	2	O.K.	3	O.K.	S	NO	U	-
		50	-	5	-	-	-	-	-	-	-	-	-
		25	-	5	-	-	-	-	-	-	-	-	-
301-54-H	Epon 1009	90	C	0	0	1	O.K.	2	O.K.	U	-	U	-
		75	C	0	1	1	O.K.	2	O.K.	S	NO	S	YES
		50	-	5	-	-	-	-	-	-	-	-	-
		25	-	5	-	-	-	-	-	-	-	-	-

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Compatibility

C - Compatible
H - Hazy
I - Incompatible

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

Table 23

Epoxy-Polyamide (Lancast A) Resin Systems

Vehicle Code	Epoxy or Epoxy Co-Polymer	%	Film Compatibility	Air Dried Film		30 min. @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
				Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-55-E	Epon 828	90	-	5	-	-	-	-	-	-	-	-	-
		75	C	3	1	2	O.K.	2	O.K.	S	NO	U	-
		50	-	5	-	-	-	-	-	-	-	-	-
		25	-	5	-	-	-	-	-	-	-	-	-
301-55-D	Epon 1001	90	C	0	0	1	O.K.	2	O.K.	S	NO	S	YES
		75	C	0	0	1	O.K.	2	O.K.	U	-	U	-
		50	-	5	-	-	-	-	-	-	-	-	-
		25	-	5	-	-	-	-	-	-	-	-	-
301-55-A	Epon 1004	90	C	0	1	1	O.K.	2	O.K.	U	-	U	-
		75	C	0	0	2	O.K.	3	O.K.	S	NO	U	-
		50	-	5	-	-	-	-	-	-	-	-	-
		25	-	5	-	-	-	-	-	-	-	-	-
301-55-B	Epon 1007	90	C	0	0	1	O.K.	3	O.K.	U	-	U	-
		75	C	0	0	2	O.K.	3	O.K.	S	NO	S	YES
		50	-	5	-	-	-	-	-	-	-	-	-
		25	-	5	-	-	-	-	-	-	-	-	-
301-55-C	Epon 1009	90	C	0	0	0	O.K.	2	O.K.	S	YES	U	-
		75	C	0	0	0	O.K.	2	O.K.	S	NO	U	-
		50	-	5	-	-	-	-	-	-	-	-	-
		25	-	5	-	-	-	-	-	-	-	-	-

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Compatibility

C - Compatible
H - Hazy
I - Incompatible

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

Table 24

Epoxy-Amino Silane (Dow Corning Z-6020) Resin Systems

Vehicle Code	Epoxy or Epoxy Co-Polymer	%	Film Compatibility	Air Dried Film		30 min. @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
				Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-63-E	Epon 828	90	C	3	3	2	O.K.	0	O.K.	S	NO	S	NO
		75	C	0	0	1	O.K.	2	O.K.	U	-	U	-
301-63-D	Epon 1001	90	C	2	3	0	O.K.	2	O.K.	U	-	U	-
		75	C	2	3	3	O.K.	3	O.K.	U	-	U	-
301-63-A	Epon 1004	90	C	0	2	2	O.K.	3	O.K.	U	-	U	-
		75	C	0	3	3	O.K.	3	O.K.	U	-	U	-
301-63-B	Epon 1007	90	C	0	2	1	O.K.	3	O.K.	U	-	U	-
		75	C	0	2	2	O.K.	3	O.K.	U	-	U	-
301-63-C	Epon 1009	90	C	0	1	0	O.K.	0	O.K.	U	-	U	-
		75	C	0	2	0	O.K.	0	O.K.	U	-	U	-
301-63-H	Dow Corning XR-6-0000	90	C	0	3	3	O.K.	3	O.K.	U	-	U	-
		75	C	0	3	3	O.K.	3	O.K.	U	-	U	-
301-63-M	Midland X-4209	90	C	0	2	3	O.K.	3	O.K.	U	-	U	-
		75	C	0	2	3	O.K.	3	O.K.	U	-	U	-

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Compatibility

C - Compatible
H - Hazy
I - Incompatible

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance	24 Hour Recovery
U - Unaffected	Yes - Recovered original properties
S - Softened	No - Did not recover original properties
D - Dissolved	

Table 25

Epoxy Novolac Resin Systems (Dow 2638.1)

Vehicle Code	Curing Agent	%	Film Compatibility	Air Dried Film		30 min.@500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant		Comments
				Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery	
301-96-A	Versamid 115	10	-	5	-	-	-	-	-	-	-	-	-	-
		25	-	5	-	-	-	-	-	-	-	-	-	-
		50	C	1	2	2	O.K.	3	O.K.	U	-	U	-	Very Brittle
301-96-B	Genamid 250	10	I	-	-	-	-	-	-	-	-	-	-	-
		25	I	-	-	-	-	-	-	-	-	-	-	-
		50	I	-	-	-	-	-	-	-	-	-	-	-
301-96-C	Lancast A	10	-	5	-	-	-	-	-	-	-	-	-	-
		25	C	2	2	2	O.K.	2	O.K.	U	-	U	-	Very Brittle
		50	-	5	-	-	-	-	-	-	-	-	-	-
301-96-D	Dow Corning Z-6020	5	-	5	-	-	-	-	-	-	-	-	-	-
		10	-	5	-	-	-	-	-	-	-	-	-	-
		15	-	5	-	-	-	-	-	-	-	-	-	-
301-96-E	Diethylene Triamine	2	-	5	-	-	-	-	-	-	-	-	-	-
		5	C	2	3	3	O.K.	2	O.K.	U	-	U	-	Very Brittle
		10	C	2	4	3	O.K.	2	O.K.	U	-	U	-	Very Brittle
301-245-G	PMDA Adduct	-	C	0	1	5	N.G.	5	N.G.	U	-	U	-	Extremely Brittle

Table 25 (continued)

Epoxy Novolac Resin Systems (Dow 2638.3)

Vehicle Code	Curing Agent	%	Film Compatibility	Air Dried Film Dry	Air Dried Film Adhesion	30 min.@500F. Adh.	30 min.@500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery	Comments
301-96-F	Versamid 115	10	-	4	4	-	-	-	-	-	-	-	-	-
		25	C	2	0	2	O.K.	2	O.K.	S	YES	U	-	Very Brittle
		50	C	3	1	3	O.K.	3	O.K.	S	YES	U	-	Very Prittle
301-96-G	Genamid 250	10	C	2	1	1	O.K.	2	O.K.	S	YES	U	-	Very Brittle
		25	H	1	3	1	O.K.	3	O.K.	S	YES	U	-	Very Brittle
		50	I	-	-	-	-	-	-	-	-	-	-	-
301-96-H	Lancast A	10	H	1	2	1	O.K.	1	O.K.	S	YES	U	-	Very Brittle
		25	H	2	4	3	O.K.	3	O.K.	U	-	U	-	Very Brittle
		50	I	-	-	-	-	-	-	-	-	-	-	-
301-96-K	Dow Corning Z-6020	5	-	5	-	-	-	-	-	-	-	-	-	-
		10	C	4	2	0	N.G.	2	N.G.	S	YES	D	-	Very Brittle
		15	C	2	0	1	O.K.	1	O.K.	U	-	U	-	Very Brittle
301-96-L	Diethylene Triamine	2	C	2	1	1	O.K.	1	O.K.	S	YES	U	-	Very Brittle
		5	C	0	0	1	O.K.	0	O.K.	U	-	S	YES	Very Brittle
		10	C	0	2	2	O.K.	1	O.K.	U	-	U	-	Very Brittle

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Compatibility

C - Compatible
H - Hazy
I - Incompatible

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

Table 26

Epoxy - Moisture Activated Catalyst (Shell H-1 and H-2) Systems

Vehicle Code	Epoxy Resin	Curing Agent	%	Air Dried Film Dry	Air Dried Film Adhesion	30 min. @500F. Adh.	30 min. @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-76-J	Epon 828	H-1	5	5	-	-	-	-	-	-	-	-	-
			10	5	-	-	-	-	-	-	-	-	-
			25	0	1	2	O.K.	2	O.K.	U	-	U	-
			50	0	3	3	O.K.	3	O.K.	U	-	U	-
301-176-K	Epon 828	H-2	5	5	-	-	-	-	-	-	-	-	-
			10	5	-	-	-	-	-	-	-	-	-
			25	5	-	-	-	-	-	-	-	-	-
			50	5	-	-	-	-	-	-	-	-	-
301-176-G	Epon 1001	H-1	5	0	1	2	O.K.	3	O.K.	U	-	U	-
			10	0	2	2	O.K.	3	O.K.	U	-	U	-
			25	0	2	3	O.K.	3	O.K.	U	-	U	-
			50	2	3	2	O.K.	3	O.K.	U	-	U	-
301-176-H	Epon 1001	H-2	5	1	0	1	O.K.	3	O.K.	S	YES	U	-
			10	0	2	0	O.K.	3	O.K.	U	-	U	-
			25	0	3	0	O.K.	2	O.K.	U	-	U	-
			50	0	3	3	O.K.	3	O.K.	U	-	U	-
301-176-C	Epon 1007	H-1	5	0	3	2	O.K.	3	EYEHOLES	U	-	U	-
			10	0	3	2	O.K.	3	EYEHOLES	U	-	U	-
			25	0	3	2	EYEHOLES	3	EYEHOLES	U	-	U	-
			50	2	4	2	EYEHOLES	3	EYEHOLES	U	-	U	-
301-176-D	Epon 1007	H-2	5	0	3	1	EYEHOLES	3	EYEHOLES	U	-	U	-
			10	0	3	3	EYEHOLES	3	EYEHOLES	U	-	U	-
			25	1	3	2	EYEHOLES	3	EYEHOLES	U	-	U	-
			50	2	4	3	EYEHOLES	3	EYEHOLES	U	-	U	-

Table 26 (continued)

Epoxy - Moisture Activated Catalyst (Shell H-1 and H-2) Systems

Vehicle Code	Epoxy Resin	Curing Agent	%	Air Dried Film		30 min. @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
				Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-176-E	Epon 1009	H-1	5	0	3	1	EYEHOLES	3	O.K.	U	-	U	-
			10	0	3	3	EYEHOLES	3	EYEHOLES	U	-	U	-
			25	1	3	2	EYEHOLES	3	EYEHOLES	U	-	U	-
			50	2	4	3	EYEHOLES	3	EYEHOLES	U	-	U	-
301-176-F	Epon 1009	H-2	5	0	3	2	EYEHOLES	3	EYEHOLES	U	-	U	-
			10	0	3	2	EYEHOLES	3	EYEHOLES	U	-	U	-
			25	1	3	2	EYEHOLES	2	EYEHOLES	U	-	U	-
			50	2	4	3	EYEHOLES	2	EYEHOLES	S	NO	U	-
301-177-A	Midland X-4209	H-1	5	0	1	2	O.K.	2	O.K.	S	YES	U	-
			10	0	3	3	O.K.	3	O.K.	S	YES	U	-
			25	1	1	3	O.K.	3	O.K.	S	YES	U	-
			50	2	2	3	O.K.	3	O.K.	S	YES	U	-
301-177-B	Midland X-4209	H-2	5	0	1	3	O.K.	3	O.K.	S	YES	U	-
			10	0	2	3	O.K.	3	O.K.	S	YES	S	YES
			25	1	2	3	O.K.	3	O.K.	S	YES	S	YES
			50	1	2	3	O.K.	3	O.K.	S	YES	U	-
301-177-C	Dow Corning XR-6-0000	H-1	5	0	1	0	O.K.	3	O.K.	U	-	U	-
			10	0	3	1	O.K.	3	O.K.	U	-	U	-
			25	0	3	3	O.K.	3	O.K.	U	-	U	-
			50	2	3	3	O.K.	3	O.K.	U	-	U	-
301-177-D	Dow Corning XR-6-0000	H-2	5	0	2	1	O.K.	3	O.K.	S	YES	U	-
			10	0	3	1	O.K.	3	O.K.	U	-	U	-
			25	0	3	3	O.K.	3	O.K.	U	-	U	-
			50	0	3	3	O.K.	3	O.K.	S	YES	U	-

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties.
No - Did not recover original properties.

P. <u>Silicone Resins Cured with #2311 Experimental Silazane</u>

1. Many of the systems in this series gelled immediately after the addition of the silazane and were of no use.

2. Resistance to the test fluids was very poor.

3. Heat resistance was excellent.

4. For details of silicone resins cured with #2311 experimental silazane, see Table 27.

Q. <u>Silicone Resins Cured with Z-6020 Amino Silane</u>

1. Some silicones do not react (or react very slowly) with Z-6020. All systems had a usable pot life.

2. Resistance to the test fluids was poor.

3. Heat resistance was good.

4. For details of silicone resins cured with Z-6020, see Table 28.

Table 27

Experimental Silazane (#2311) Catalyzed Silicone Resins

Vehicle Code	Silicone Resin	%	Film Compatibility	Air Dried Film Dry	Air Dried Film Adhesion	30 min. @500F. Adh.	30 min. @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery	Comments
301-98-A	SR-28	95	C	5	-	-	-	-	-	-	-	-	-	-
		90	-	-	-	-	-	-	-	-	-	-	-	Immediate Gel
		85	-	-	-	-	-	-	-	-	-	-	-	Immediate Gel
301-98-B	XR-261	95	C	0	3	3	O.K.	3	O.K.	D	-	D	-	-
		90	C	4	-	-	-	-	-	-	-	-	-	-
		85	C	4	-	-	-	-	-	-	-	-	-	-
301-98-C	SR-111	95	C	4	-	-	-	-	-	-	-	-	-	-
		90	C	4	-	-	-	-	-	-	-	-	-	-
		85	-	-	-	-	-	-	-	-	-	-	-	Immediate Gel
301-98-D	SR-98	95	-	-	-	-	-	-	-	-	-	-	-	Immediate Gel
		90	-	-	-	-	-	-	-	-	-	-	-	Immediate Gel
		85	-	-	-	-	-	-	-	-	-	-	-	Immediate Gel
301-98-E	SR-17	95	-	-	-	-	-	-	-	-	-	-	-	Immediate Gel
		90	-	-	-	-	-	-	-	-	-	-	-	Immediate Gel
		85	-	-	-	-	-	-	-	-	-	-	-	Immediate Gel
301-98-F	ST-847	95	C	0	3	3	O.K.	1	O.K.	S	NO	S	NO	-
		90	C	0	3	1	O.K.	0	O.K.	S	NO	S	NO	-
		85	C	0	4	3	O.K.	3	O.K.	S	NO	S	NO	-
301-98-G	DC-802	95	C	3	-	-	-	-	-	-	-	-	-	-
		90	C	2	3	3	O.K.	3	O.K.	D	-	S	NO	-
		85	C	2	4	3	O.K.	3	O.K.	S	NO	D	-	-

Table 27 (continued)

Experimental Silazane (#2311) Catalyzed Silicone Resins

Vehicle Code	Silicone Resin	%	Film Compatibility	Air Dried Film		30 min. @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant		Comments
				Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery	
301-98-H	DC-803	95	C	0	4	3	O.K.	3	O.K.	D	-	D	-	-
		90	C	0	3	2	O.K.	2	O.K.	D	-	D	-	-
		85	C	0	3	2	O.K.	3	O.K.	D	-	D	-	-
301-98-K	DC-806A	95	C	0	2	2	O.K.	2	O.K.	D	-	D	-	-
		90	C	0	3	2	O.K.	3	O.K.	D	-	D	-	-
		85	C	0	2	2	O.K.	3	O.K.	D	-	D	-	-
301-99-A	R-6-0031	95	-	-	-	-	-	-	-	-	-	-	-	Immediate Gel
		90	-	-	-	-	-	-	-	-	-	-	-	Immediate Gel
		85	-	-	-	-	-	-	-	-	-	-	-	Immediate Gel
301-99-B	SR-119	95	C	2	4	3	O.K.	3	O.K.	D	-	D	-	Little Reaction
		90	C	2	3	3	O.K.	3	O.K.	D	-	D	-	Little Reaction
		85	C	1	4	3	O.K.	3	O.K.	D	-	D	-	Little Reaction
301-99-C	ST-856	95	C	5	-	-	-	-	-	-	-	-	-	Little Reaction
		90	C	5	-	-	-	-	-	-	-	-	-	Little Reaction
		85	C	4	-	-	-	-	-	-	-	-	-	Little Reaction
301-99-D	XR-856	95	C	2	3	2	O.K.	2	O.K.	D	-	D	-	-
		90	C	3	-	-	-	-	-	-	-	-	-	-
		85	C	5	-	-	-	-	-	-	-	-	-	-
301-99-E	DC-805	95	C	3	-	-	-	-	-	-	-	-	-	-
		90	-	-	-	-	-	-	-	-	-	-	-	Immediate Gel
		85	-	-	-	-	-	-	-	-	-	-	-	Immediate Gel

Table 27 (continued)

Experimental Silazane (#2311) Catalyzed Silicone Resins

Vehicle Code	Silicone Resin	%	Film Compatibility	Air Dried Film		30 min. @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant		Comments
				Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery	
301-99-F	SR-32	95	-	-	-	-	-	-	-	-	-	-	-	Immediate Gel
		90	-	-	-	-	-	-	-	-	-	-	-	Immediate Gel
		85	-	-	-	-	-	-	-	-	-	-	-	Immediate Gel
301-99-G	XR-630	95	C	0	3	3	O.K.	3	O.K.	D	-	S	NO	-
		90	C	0	3	3	O.K.	3	O.K.	D	-	S	NO	-
		85	C	0	3	3	O.K.	3	O.K.	D	-	S	NO	-
301-27-A	SR-82	95	C	0	2	2	O.K.	2	O.K.	D	-	D	-	-
		90	C	0	2	2	O.K.	2	O.K.	D	-	D	-	-
		85	C	0	2	3	O.K.	3	O.K.	D	-	D	-	-
301-27-B	DC-840	95	C	0	4	3	O.K.	3	O.K.	D	-	D	-	-
		90	C	0	4	3	O.K.	3	O.K.	D	-	S	NO	-
		85	C	0	4	2	O.K.	2	O.K.	D	-	D	-	-
301-27-C	R-64	95	C	0	3	1	O.K.	2	O.K.	D	-	D	-	-
		90	C	0	4	2	O.K.	2	O.K.	D	-	D	-	-
		85	C	0	4	0	O.K.	2	O.K.	D	-	D	-	-
301-27-D	SR-120	95	C	3	-	-	-	-	-	-	-	-	-	Little Reaction
		90	C	3	-	-	-	-	-	-	-	-	-	Little Reaction
		85	C	4	-	-	-	-	-	-	-	-	-	Little Reaction
301-27-E	R-4471	95	C	0	2	2	O.K.	2	O.K.	D	-	D	-	-
		90	C	0	3	1	O.K.	2	O.K.	D	-	D	-	-
		85	C	0	3	2	O.K.	2	O.K.	D	-	D	-	-

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Compatibility

C - Compatible
H - Hazy
I - Incompatible

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

Table 28

Amino Silane (Z-6020) Catalyzed Silicone Resins

Vehicle Code	Silicone Resin	%	Film Compatibility	Air Dried Film		30 min. @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
				Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-60-A	SR-28	99	C	5	-	-	-	-	-	-	-	-	-
		97	C	5	-	-	-	-	-	-	-	-	-
301-60-B	XR-261	99	C	0	3	4	O.K.	3	O.K.	D	-	S	NO
		97	C	0	3	4	O.K.	4	O.K.	D	-	D	-
301-60-C	SR-111	99	C	5	-	-	-	-	-	-	-	-	-
		97	C	3	3	4	O.K.	4	O.K.	S	NO	S	NO
301-60-D	SR-98	99	C	0	1	4	O.K.	4	O.K.	D	-	D	-
		97	C	0	3	3	O.K.	4	O.K.	D	-	D	-
301-60-E	SR-17	99	C	5	-	-	-	-	-	-	-	-	-
		97	C	2	3	4	O.K.	4	O.K.	S	NO	S	NO
301-60-F	ST-847	99	C	0	4	4	O.K.	4	O.K.	S	NO	S	NO
		97	C	0	3	3	O.K.	3	O.K.	S	NO	S	NO
301-60-G	DC-802	99	C	3	3	3	O.K.	3	O.K.	D	-	S	NO
		97	C	1	2	3	O.K.	4	O.K.	S	YES	S	NO
301-60-H	DC-803	99	C	0	3	4	O.K.	3	O.K.	S	NO	S	NO
		97	C	0	3	4	O.K.	4	O.K.	S	NO	S	NO
301-61-A	DC-806A	99	C	0	2	3	O.K.	3	O.K.	D	-	S	NO
		97	C	0	3	3	O.K.	3	O.K.	D	-	S	NO
301-61-B	R-6-0031	99	C	3	3	3	O.K.	3	O.K.	D	-	D	-
		97	C	0	3	3	O.K.	3	O.K.	S	NO	D	-

Table 28 (continued)

Amino Silane (Z-6020) Catalyzed Silicone Resins

Vehicle Code	Silicone Resin	%	Film Compatibility	Air Dried Film		30 min. @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
				Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-61-C	SR-119	99	C	5	-	-	-	-	-	-	-	-	-
		97	C	0	3	4	O.K.	4	O.K.	D	-	D	-
301-61-D	ST-856	99	C	0	3	2	O.K.	3	O.K.	D	-	D	-
		97	C	0	3	2	O.K.	3	O.K.	D	-	D	-
301-61-E	XR-856	99	C	3	3	3	O.K.	3	O.K.	D	-	D	-
		97	C	0	3	4	O.K.	4	O.K.	D	-	D	-
301-61-F	DC-805	99	C	5	-	-	-	-	-	-	-	-	-
		97	C	3	3	4	O.K.	4	O.K.	D	-	S	NO
301-61-G	SR-32	99	C	5	-	-	-	-	-	-	-	-	-
		97	C	3	3	3	O.K.	3	O.K.	D	-	S	NO
301-61-H	XR-630	99	C	0	3	4	O.K.	3	O.K.	D	-	S	NO
		97	C	0	2	4	O.K.	4	O.K.	D	-	S	NO
301-62-A	SR-82	99	C	0	3	4	O.K.	4	O.K.	D	-	D	-
		97	C	0	3	4	O.K.	4	O.K.	D	-	D	-
301-62-B	DC-840	99	C	0	3	4	O.K.	4	O.K.	D	-	D	-
		97	C	0	3	4	O.K.	3	O.K.	D	-	S	NO
301-62-C	R-64	99	C	0	3	4	O.K.	4	O.K.	D	-	D	-
		97	C	0	3	4	O.K.	4	O.K.	D	-	S	NO
301-62-D	SR-120	99	C	5	-	-	-	-	-	-	-	-	-
		97	C	5	-	-	-	-	-	-	-	-	-

Key to Numerical Ratings and Symbols

Rating	Hard	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Compatibility

C - Compatible
H - Hazy
I - Incompatible

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

R. Half Second RS Nitrocellulose Modification of Fluorinated Hydrocarbon Resins

1. Compatibility of nitrocellulose and the fluorinated resins was good.

2. The test fluid resistance of some of these systems was good.

3. A few of these coatings decomposed during the heat test but most were satisfactory.

4. Details of nitrocellulose modification of fluorinated resins can be found in Table 29.

S. Polyvinyl Butyral Modification of Fluorinated Hydrocarbon Resins

1. Compatibility of Bakelite XYHL and the fluorinated resins was poor.

2. Resistance to the test fluids was poor.

3. Heat Resistance was good.

4. For details of Bakelite XYHL modification of fluorinated hydrocarbon resins, see Table 30.

Table 29

Half Second RS Nitrocellulose Modification of Fluorinated Hydrocarbon Resins

Vehicle Code	Fluorinated Resin	%	Film Compatibility	Air Dried Film		30 min. @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
				Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-47-A	Viton A	90	H	1	3	3	O.K.	2	O.K.	S	YES	S	NO
		75	H	0	4	3	O.K.	3	O.K.	U	-	S	NO
		50	H	0	4	3	O.K.	3	O.K.	U	-	D	-
301-48-A	Exon 461	90	C	0	4	4	O.K.	4	O.K.	D	-	D	-
		75	C	0	4	3	O.K.	DECOMPOSED		D	-	D	-
		50	C	0	4	DECOMPOSED		DECOMPOSED		D	-	D	-
301-49-A	KEL-F Fluorel	90	H	0	4	4	O.K.	3	O.K.	S	YES	U	-
		75	H	0	5	4	O.K.	5	B	S	NO	S	NO
		50	H	0	4	3	O.K.	DECOMPOSED		U	-	S	YES
301-50-A	KEL-F 800	90	C	0	4	3	O.K.	3	O.K.	S	NO	U	-
		75	C	0	4	4	O.K.	3	O.K.	S	YES	U	-
		50	C	0	4	4	O.K.	4	O.K.	U	-	U	-

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Compatibility

C- Compatible
H- Hazy
I- Incompatible

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U- Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

Table 30

Polyvinyl Butyral (Bakelite XYHL) Modification of Fluorinated Hydrocarbon Resins

Vehicle Code	Fluorinated Resin	%	Film Compatibility	Air Dried Film		30 min. @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
				Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-47-B	Viton A	90	I	-	-	-	-	-	-	-	-	-	-
		75	H	0	4	3	O.K.	3	O.K.	S	YES	S	NO
		50	H	0	4	3	O.K.	3	O.K.	S	YES	S	NO
301-48-B	Exon 461	90	I	-	-	-	-	-	-	-	-	-	-
		75	H	0	4	4	O.K.	4	O.K.	D	-	D	-
		50	H	0	4	3	O.K.	3	O.K.	D	-	U	-
301-49-B	KEL-F Fluorel	90	I	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-
		50	H	0	4	2	O.K.	2	O.K.	S	NO	S	NO
301-50-B	KEL-F 800	90	I	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-
		50	I	-	-	-	-	-	-	-	-	-	-

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Compatibility

C - Compatible
H - Hazy
I - Incompatible

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

T. Acryloid A-101 Modification of Fluorinated Hydrocarbon Resins

1. Compatibility of Acryloid A-101 and the fluorinated resins was fairly good.

2. Resistance to lubricant and MIL-S-3136 fluid was generally good.

3. Heat resistance was good.

4. For details of Acryloid A-101 modification of fluorinated hydrocarbon resins, see Table 31.

U. Styrene Butadiene Modification of Fluorinated Hydrocarbon Resins

1. Compatibility of Pliolite S-5 and the fluorinated resins was fair.

2. Resistance to the test fluids was poor.

3. Except for two systems, heat resistance was good.

4. For details of Pliolite S-5 modifications of fluorinated resins, see Table 32.

Table 31

Acrylic (Acryloid A-101) Modification of Fluorinated Hydrocarbon Resins

Vehicle Code	Fluorinated Resin	%	Film Compatibility	Air Dried Film		30 min. @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
				Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-47-D	Viton A	90	C	0	4	3	O.K.	3	O.K.	S	NO	U	-
		75	C	0	5	3	O.K.	3	O.K.	S	NO	U	-
		50	H	0	5	3	O.K.	3	O.K.	S	NO	U	-
301-48-D	Exon 461	90	C	0	4	3	O.K.	3	O.K.	D	-	S	YES
		75	C	0	5	3	O.K.	3	O.K.	S	NO	U	-
		50	H	0	5	2	O.K.	3	O.K.	S	NO	U	-
301-49-D	KEL-F Fluorel	90	C	0	4	3	O.K.	3	O.K.	U	-	U	-
		75	C	0	4	2	O.K.	2	O.K.	U	-	U	-
		50	H	0	4	2	O.K.	3	B	U	-	U	-
301-50-D	KEL-F 800	90	H	0	4	3	O.K.	3	O.K.	S	YES	U	-
		75	H	0	4	4	O.K.	4	O.K.	S	YES	U	-
		50	H	0	4	2	O.K.	2	O.K.	U	-	U	-

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Compatibility

C - Compatible
H - Hazy
I - Incompatible

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance	24 Hour Recovery
U - Unaffected	Yes - Recovered original properties
S - Softened	No - Did not recover original properties
D - Dissolved	

Table 32

Styrene Butadiene (Pliolite S-5) Modification of Fluorinated Hydrocarbon Resins

Vehicle Code	Fluorinated Resin	%	Film Compatibility	Air Dried Film		30 min. @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
				Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-47-E	Viton A	90	H	1	4	3	O.K.	3	O.K.	S	NO	U	-
		75	H	0	4	3	O.K.	3	O.K.	S	NO	U	-
		50	H	0	3	3	O.K.	3	O.K.	D	-	U	-
301-48-E	Exon 461	90	C	0	4	4	O.K.	4	O.K.	D	-	D	-
		75	C	0	4	3	O.K.	DECOMPOSED		D	-	D	-
		50	C	0	4	DECOMPOSED		DECOMPOSED		D	-	D	-
301-49-E	KEL-F Fluorel	90	H	0	5	5	O.K.	4	O.K.	S	NO	U	-
		75	H	0	5	5	O.K.	3	O.K.	S	NO	S	NO
		50	I	-	-	-	-	-	-	-	-	-	-
301-50-E	KEL-F 800	90	I	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-
		50	H	0	4	3	O.K.	4	O.K.	S	NO	U	-

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Compatibility

C - Compatible
H - Hazy
I - Incompatible

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

V. <u>Triazine Formaldehyde Modification of Fluorinated Hydrocarbon Resins</u>

1. Compatibility of Uformite M-311 and the fluorinated hydrocarbon resins was fair.

2. Resistance to the test fluids was poor.

3. Heat resistance was good.

4. For details of Uformite M-311 modification of fluorinated resins, see Table 33.

W. <u>Polyvinyl Formal Modification of Fluorinated Hydrocarbon Resins</u>

1. Compatibility of Formvar 7/70 and the fluorinated resins was fair.

2. Resistance to the test fluids was poor.

3. Heat resistance was good.

4. Details of Formvar 7/70 modifications of fluorinated hydrocarbon resins may be found in Table 34.

Table 33

Triazine Formaldehyde (Uformite M-311) Modification of Fluorinated Hydrocarbon Resins

Vehicle Code	Fluorinated Resin	%	Film Compatibility	Air Dried Film		30 min. @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
				Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-47-F	Viton A	90	I	-	-	-	-	-	-	-	-	-	-
		75	I	-	-	-	-	-	-	-	-	-	-
		50	H	O	4	3	O.K.	4	O.K.	S	NO	U	-
301-48-F	Exon 461	90	C	O	4	4	O.K.	4	O.K.	D	-	D	-
		75	H	O	4	5	O.K.	3	O.K.	D	-	D	-
		50	H	O	4	3	O.K.	5	O.K.	D	-	D	-
301-49-F	KEL-F Fluorel	90	H	O	4	3	O.K.	3	O.K.	S	NO	S	NO
		75	H	O	4	3	O.K.	3	O.K.	S	NO	S	NO
		50	I	-	-	-	-	-	-	-	-	-	-
301-50-F	KEL-F 800	90	C	O	4	4	O.K.	4	O.K.	S	NO	U	-
		75	C	O	4	4	O.K.	3	O.K.	D	-	U	-
		50	I	-	-	-	-	-	-	-	-	-	-

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Compatibility

C - Compatible
H - Hazy
I - Incompatible

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

Table 34

Polyvinyl Formal (Formvar 7/70) Modification of Fluorinated Hydrocarbon Resins

Vehicle Code	Fluorinated Resin	%	Film Compatibility	Air Dried Film Dry	Air Dried Film Adhesion	30 min. @500F. Adh.	30 min. @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery
301-47-G	Viton A	90	H	0	4	3	O.K.	3	O.K.	S	YES	U	-
		75	H	0	4	3	O.K.	3	O.K.	S	NO	U	-
		50	H	0	3	3	O.K.	3	O.K.	S	NO	U	-
301-48-G	Exon 461	90	C	0	4	3	O.K.	3	O.K.	D	-	D	-
		75	I	-	-	-	-	-	-	-	-	-	-
		50	H	0	4	3	O.K.	5	O.K.	D	-	D	-
301-49-G	KEL-F Fluorel	90	C	0	4	2	O.K.	3	O.K.	S	YES	S	NO
		75	C	0	4	3	O.K.	3	O.K.	S	YES	S	NO
		50	C	0	4	3	O.K.	3	O.K.	S	NO	S	NO
301-50-G	KEL-F 800	90	I	-	-	-	-	-	-	-	-	-	-
		75	H	0	5	3	O.K.	3	O.K.	S	NO	U	-
		50	H	0	5	3	O.K.	3	O.K.	D	-	S	NO

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Compatibility

C - Compatible
H - Hazy
I - Incompatible

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

X. Miscellaneous Resin Systems

1. Many of the miscellaneous resin systems tested showed great promise in the initial screening tests. Most of the better coatings were based on epoxies, polyurethanes, or polyesters.

2. For results of testing the miscellaneous resin systems, see Table 35.

Table 35

Miscellaneous Resin Systems

Vehicle Code	Type of Resin	Air Dried Film Dry	Air Dried Film Adhesion	30 min. @500F. Adh.	30 min. @500F. Film Integrity	2 hr. @500F. Adh.	2 hr. @500F. Film Integrity	MIL-S-3136 Fluid 4 hr. Immers.	MIL-S-3136 Fluid 24 hr. Recovery	Lubricant 4 hr. Immers.	Lubricant 24 hr. Recovery	Comments
301-28-A	90% Midland R62 10% ½" RS N.C.	0	3	2	B	2	B	D	-	S	NO	-
	75% Midland R62 25% ½" RS N.C.	0	1	2	B	2	B	S	NO	S	NO	-
	50% Midland R62 50% ½" RS N.C.	0	1	2	O.K.	2	O.K.	U	-	U	-	-
301-28-B	90% Midland R62 10% ½" SS N.C.	1	2	2	B	2	B	D	-	S	NO	-
	75% Midland R62 25% ½" SS N.C.	0	2	2	B	2	B	S	NO	S	NO	-
	50% Midland R62 50% ½" SS N.C.	0	1	2	B	2	B	U	-	S	NO	-
301-28-C	90% Midland R62 10% Acryloid A-101	-	-	-	-	-	-	-	-	-	-	Incompatible
	75% Midland R62 25% Acryloid A-101	-	-	-	-	-	-	-	-	-	-	Incompatible
	50% Midland R62 50% Acryloid A-101	1	4	4	O.K.	4	O.K.	S	NO	U	-	-
301-28-D	90% Midland R62 10% ½" CAB	1	3	3	O.K.	3	O.K.	S	NO	S	NO	-
	75% Midland R62 25% ½" CAB	0	3	3	O.K.	3	O.K.	S	NO	S	NO	-
	50% Midland R62 50% ½" CAB	0	4	3	O.K.	3	O.K.	D	-	S	YES	-
301-55-F	Spenkel XP-1078 Polyurethane	0	3	4	O.K.	DECOMPOSED		S	YES	U	-	-
301-55-G	Roskydol Polyester	0	3	3	O.K.	3	O.K.	U	-	U	-	-
301-62-F	63% XR-6-0031: 90% Multron R-16: 28% Mondur CB-75	0	3	2	O.K.	2	O.K.	S	YES	U	-	-
301-78-N	Paraplex P-444A Polyester	2	0	0	O.K.	1	O.K.	S	NO	S	NO	-
301-242-A	95% Midland X-4323 5% DET	3	2	3	O.K.	4	O.K.	S	YES	S	NO	Very Brittle
301-242-B	90% Midland X-4323 10% DET	4	2	3	O.K.	4	O.K.	S	YES	U	-	Very Brittle

Table 35 (continued)

Miscellaneous Resin Systems

Vehicle Code	Type of Resin	Air Dried Film		30 min. @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant		Comments
		Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery	
301-242-C	85% Midland X-4323 15% DET	4	2	3	O.K.	4	O.K.	S	YES	U	-	Very Brittle
301-242-D	75% Midland X-4323 25% Versamid 115	1	2	1	O.K.	1	O.K.	D	-	U	-	Very Brittle
301-242-E	50% Midland X-4323 50% Versamid 115	2	2	1	O.K.	1	O.K.	D	-	D	-	Very Brittle
301-330-A	52% Midland X-4323:48% Mondur CB-75	0	0	-	-	-	-	U	-	U	-	Slightly Brittle
301-330-B	40% X-4323: 33% Mondur CB-75: 27% Multron R-16	0	4	-	-	-	-	S	YES	U	-	-
301-330-C	25% X-4323: 24% Mondur CB-75: 51% Multron R-16	0	3	-	-	-	-	S	YES	S	NO	-
301-330-D	12% X-4323: 18% Mondur CB-75: 70% Multron R-16	3	3	-	-	-	-	S	NO	S	NO	-
301-330-E	48% Midland X-4323: 52% Midland X-3934	1	0	-	-	-	-	S	YES	U	-	-
301-330-F	45% Midland X-4323: 55% Midland X-3934	0	0	-	-	-	-	S	YES	U	-	-
301-330-G	43% Midland X-4323: 57% Midland X-3934	0	0	-	-	-	-	S	YES	U	-	-
301-350-A	Enjay Buton 300	0	5	-	-	-	-	S	YES	U	-	Very Brittle
301-407-A	Polylite 8703 Polyester	0	4	-	-	-	-	U	-	U	-	Very Brittle
301-407-B	Polylite 8702 Polyester	0	4	-	-	-	-	U	-	U	-	Very Brittle
301-407-C	50% Polylite 8702: 50% Polylite 8703	0	4	-	-	-	-	U	-	U	-	Very Brittle

Table 35 (continued)

Miscellaneous Resin Systems

Vehicle Code	Type of Resin	Air Dried Film		30 min. @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant		Comments
		Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery	
301-428-A	Phenoxy Siloxane	1	1	-	-	-	-	S	NO	S	NO	Brittle
301-245-A	57% Oxiron 2000: 38% PMDA Adduct A 5% Resimene 882	0	1	1	O.K.	1	O.K.	U	-	U	-	-
301-245-B	60% Oxiron 2000: 40% PMDA Adduct A	0	1	1	O.K.	1	O.K.	U	-	U	-	-
301-428-B	75% Dow Corning XR-6-0000: 25% Dow Corning XZ-2-2023	0	2	-	-	-	-	U	-	U	-	Slightly Brittle
301-428-C	70% Oxiron 2000: 30% XZ-2-2023	5	-	-	-	-	-	-	-	-	-	-
301-428-D	50% Epon 1007: 50% XZ-2-2023	2	1	-	-	-	-	U	-	U	-	-
301-434-A	50% Aroflint 202-XA1-60: 50% 303-X-90	0	1	-	-	-	-	S	YES	U	-	Slightly Brittle
301-434-B	40% Aroflint 202-XA1-60: 60% 303-X-90	0	1	-	-	-	-	S	YES	U	-	-
301-244-J	Cargill #1459 Urethane	1	2	1	O.K.	0	O.K.	S	YES	U	-	-

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

Section IV

Development of Primer

A. Initial Vehicles Used

After the screening tests had been completed on the clear resin systems, the test results were reviewed and the following vehicles were chosen for use in primers:

1. 50% Midland R-62
   50% Half Second RS Nitrocellulose

2. 50% Dow Corning R-6-0031
   50% Half Second RS Nitrocellulose

3. 50% Plaskon ST-856
   50% Half Second RS Nitrocellulose

4. 50% Dow Corning DC-803
   50% Half Second Cellulose Acetate Butyrate

5. 50% Dow Corning DC-805
   50% Half Second Cellulose Acetate Butyrate

6. 50% General Electric SR-82
   50% Formvar 7/70

7. 50% Kel F 800
   50% Acryloid A-101

8. 75% Kel F Fluorel
   25% Acryloid A-101

9. 50% Dow Corning R-6-0031
   50% Bakelite BRS-2600

10. 25% Plaskon ST-847
    75% Midland R-55

11. Roskydol 500 Catalyzed Polyester

12. 73% Dow Corning R-6-0031
    5% Mobay Multron R-16
    22% Mobay Mondur CB-75

13. 90% Epon 1009
    10% Versamid 115

14. 90% Epon 1009
    10% Dow Corning Z-6020

15. Epon 1009 catalyzed with diethylene triamine (DET).

16. 75% Epon 1001
    25% Versamid 115

17. 90% Epon 1001
    10% Dow Corning Z-6020

18. Epon 1001 catalyzed with diethylene triamine (DET).

19. 75% Dow Corning XR-6-0000
    25% Versamid 115

20. 75% Midland X-4209

    25% Versamid 115

21. 75% Dow Corning XR-6-0000

    25% Dow Corning Z-6020

22. 75% Midland X-4209

    25% Dow Corning Z-6020

It will be noted that several vehicles which appear in Table 35 and seem to have some promise are not included in this list. These materials were evaluated later in the contract and will be mentioned later in the report.

B. Pigments Used

Previous work[1] to develop a coating system for magnesium included an extensive evaluation of corrosion inhibiting pigments. It was determined that the chromates of calcium and strontium were among the most effective for protection of magnesium. These pigments were selected for the primers. Zinc chromate was believed worthy of testing and was also included.

The same previous work[2] found a pigment content of 35% by weight to provide the optimum protection of magnesium. This pigment content was chosen for the initial pigment study. No extender pigments were used.

1. The reference may be found in the bibliography section of the appendix.
2. Ibid.

C. Bimetallic Corrosion Testing

It was decided to form a bimetallic couple between the coated magnesium panel and 17-7PH stainless steel to test the effectiveness of the coatings in preventing galvanic corrosion. The coated magnesium panel and the stainless steel strip were mounted approximately 1 inch apart in a wooden mounting block and were then connected with a copper wire and clips. The magnesium panel was scraped with a knife to bare metal where the clip was attached. (See fig. 1)

Initially, some panels had been coated with 0.0005, 0.0010, and 0.0015 inches of two of the primers. The panels were connected to the stainless steel and immersed in 1 and 5% NaCl solutions which were contained in 1 gallon glass jars. The panels were immersed to a depth of 4 inches and the immersed anode: cathode area ratio was 4:1 (See fig. 2). A number of materials were used to cover the uncoated edges of the panels. It was found that black electrical tape put on the edges of the panel and coated with a layer of paraffin afforded the best protection. It was also determined that a coating thickness of 0.0015 inches and an electrolyte concentration of 1% NaCl produced the most consistent results. All coatings were tested for bimetallic corrosion resistance in this manner. Table 36 explains the symbols used in rating bimetallic corrosion.

FIG. 1

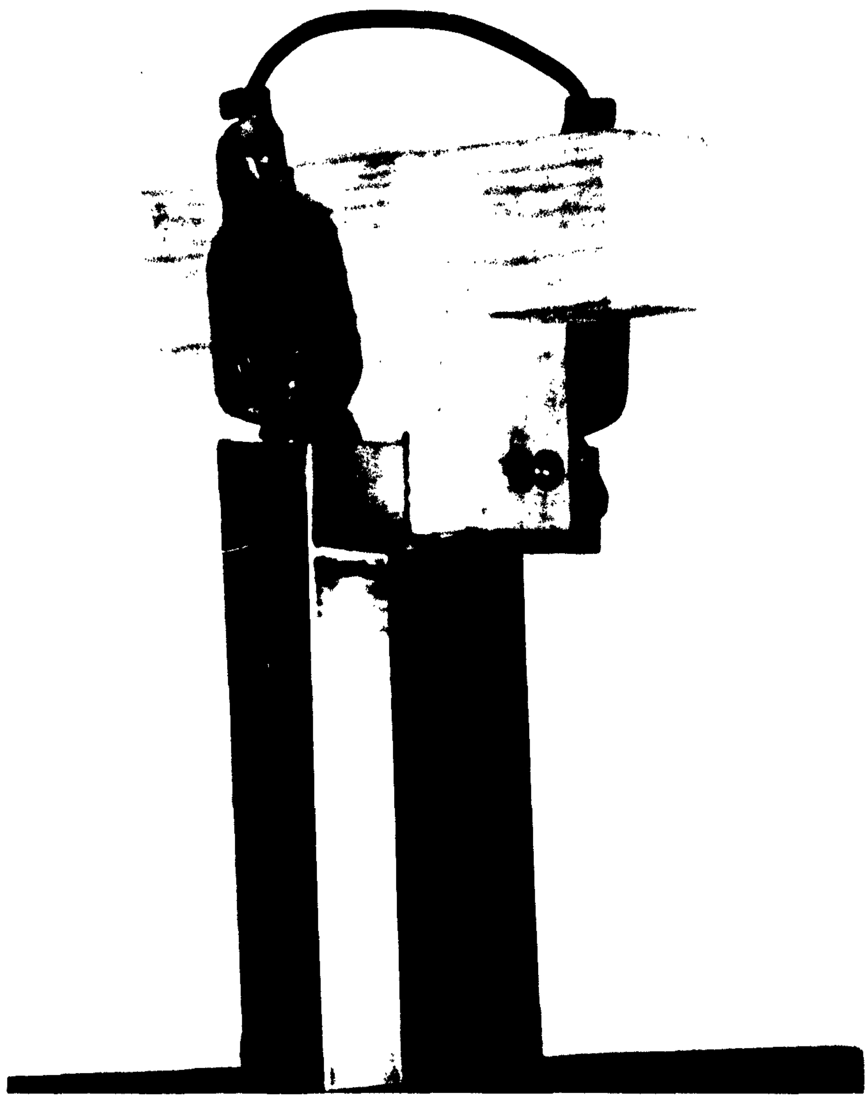


Fig. 1

MOUNTING OF BIMETALLIC CORROSION TEST PANELS

FIG. 2

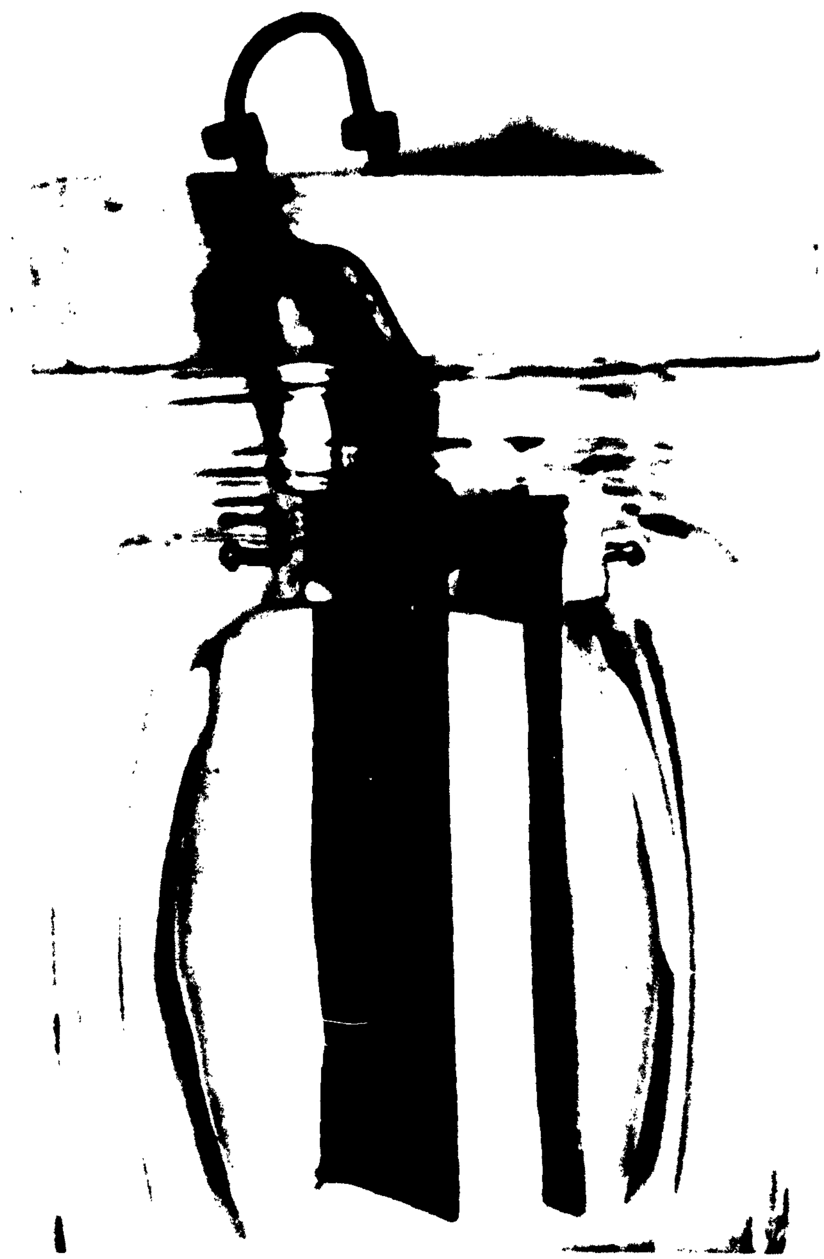


Fig. 2

BIMETALLIC CORROSION TEST CELL

Table 36

Bimetallic Corrosion Rating System

The following ratings are used in all bimetallic corrosion tables:

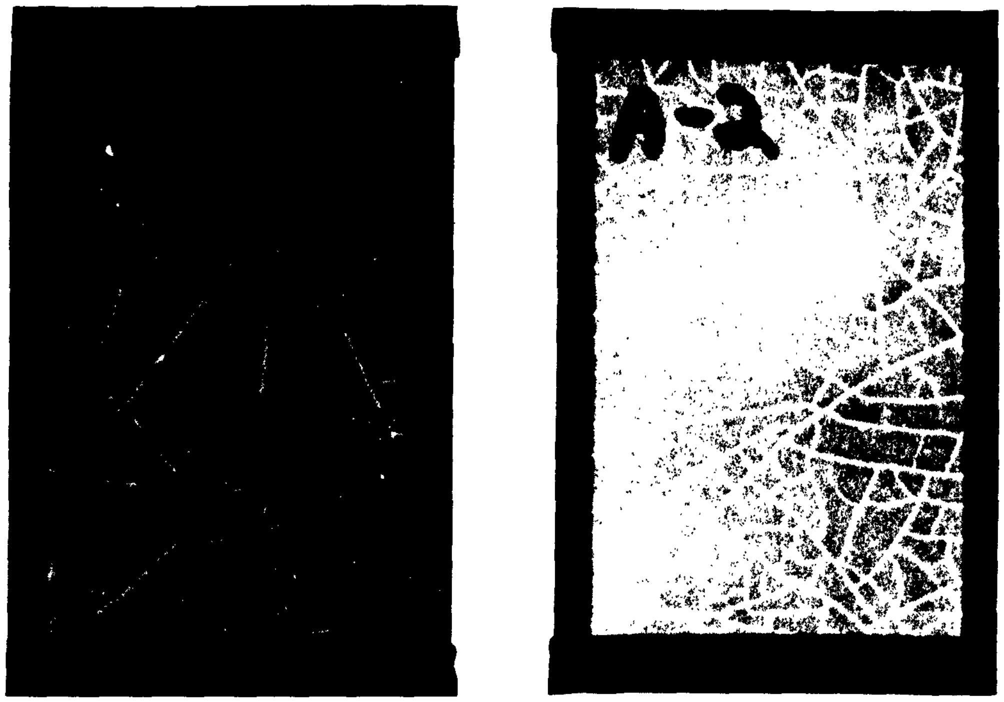
Rating	Hours Exposed	Condition of Panel
0	500	Perfect.
1	500	Very few very small blisters or slight discoloration.
2	500	Many small blisters and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

The following symbols may also be found:

N.T. - The coating was not tested due to some film failure such as cracking. (See fig. 3)

G - The coating gelled during preparation and could not be tested.

FIG. 3



EXAMPLES OF PANELS WHICH HAVE CRACKED UPON DRYING

Fig. 3

PANELS NOT TESTED DUE TO CRACKING OF TOPCOAT

D. Results of Bimetallic Corrosion Testing

As a result of the galvanic corrosion tests, the following primers were selected for further testing:

1. 301-103-A
2. 301-101-D
3. 301-131-B

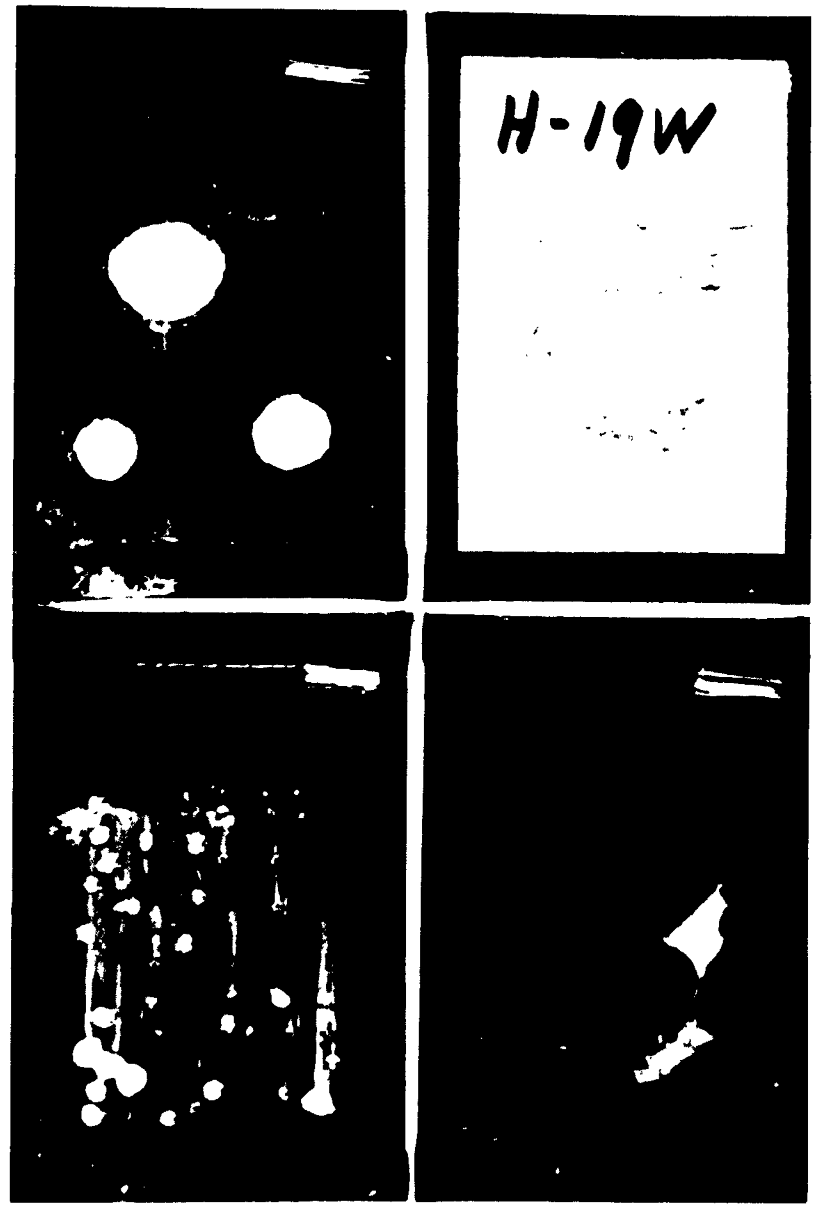
The results of galvanic corrosion testing of the primers may be found in Table 37.

E. Addition of Inert Pigments to Primers

Most of the failures which occurred during the galvanic corrosion testing of the primers were due to blistering and/or corrosion. (See fig. 4) It was decided to evaluate the addition of extender pigments to these coatings in an attempt to reduce the blistering. The inert pigments used were talc and clay. The total pigment content was kept at 35% by weight.

It was found that no improvement was made in the performance of the topcoats tested but rather the galvanic corrosion resistance of the coatings containing the extender pigments was worse than that of the original coatings. (See fig. 5) For results of galvanic corrosion testing of primers containing extender pigments, see Table 38.

FIG. 4

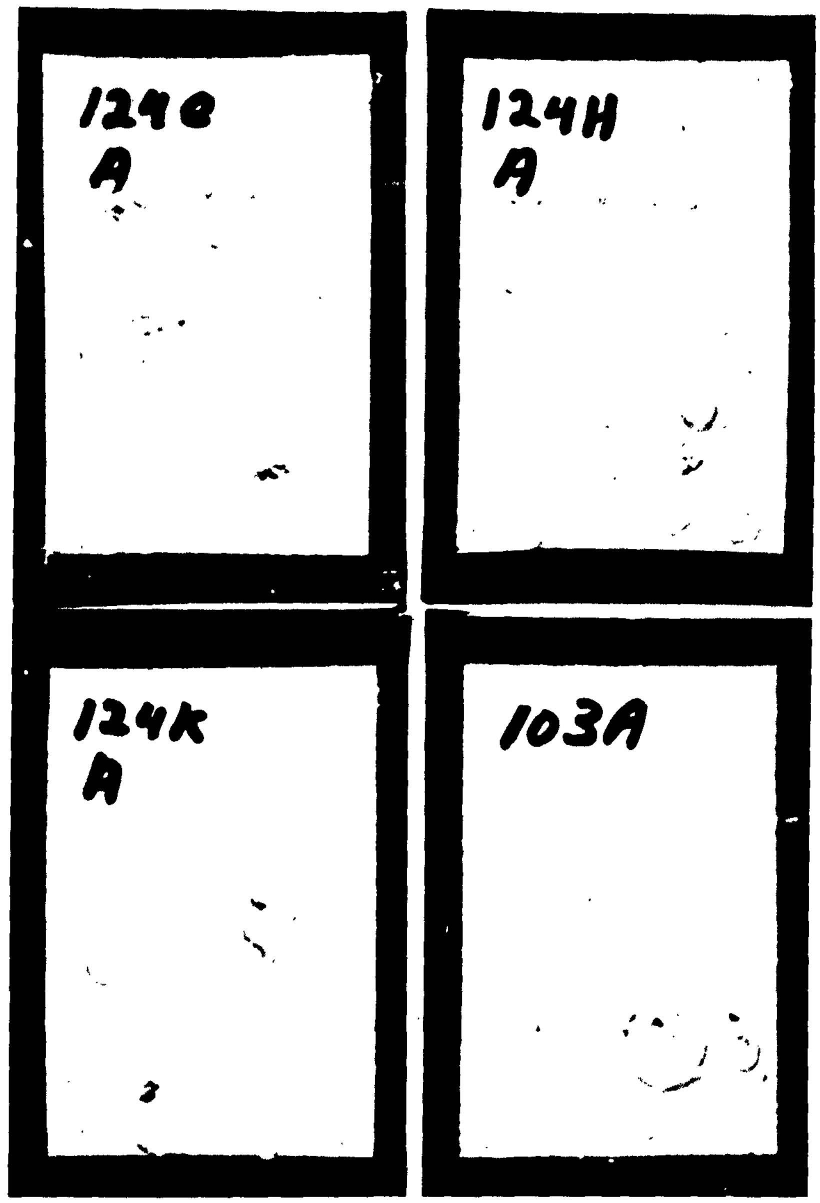


EXAMPLES OF POOR GALVANIC CORROSION RESISTANCE
ALL FAILED IN LESS THAN 500 HOURS

Fig. 4

TYPICAL GALVANIC CORROSION FAILURES

FIG. 5



RESULTS OF ADDING INERT PIGMENTS TO PRIMERS ALONE
124G, H, K - INERTS 300 HRS. IN CELL, 103A - NONE 500 HRS.

Fig. 5

GALVANIC CORROSION TESTING OF PRIMERS
CONTAINING EXTENDER PIGMENTS

Table 37

Bimetallic Corrosion Testing of Primers

Primer Code	Primer Vehicle	Pigment	Rating
301-100-A	Midland R-62: ½" Nitrocellulose	Zinc Chromate	4
301-100-B	Midland R-62: ½" Nitrocellulose	Strontium Chromate	5
301-100-C	Midland R-62: ½" Nitrocellulose	Calcium Chromate	5
301-100-D	Dow Corning R-6-0031: ½" Nitrocellulose	Zinc Chromate	5
301-100-E	Dow Corning R-6-0031: ½" Nitrocellulose	Strontium Chromate	5
301-100-F	Dow Corning R-6-0031: ½" Nitrocellulose	Calcium Chromate	5
301-100-G	Plaskon ST-856: ½" Nitrocellulose	Zinc Chromate	5
301-100-H	Plaskon ST-856: ½" Nitrocellulose	Strontium Chromate	5
301-100-K	Plaskon ST-856: ½" Nitrocellulose	Calcium Chromate	5
301-101-A	DC-803: ½" CAB	Zinc Chromate	5
301-101-B	DC-803: ½" CAB	Strontium Chromate	5
301-101-C	DC-803: ½" CAB	Calcium Chromate	5
301-101-D	DC-805: ½" CAB	Zinc Chromate	3
301-101-E	DC-805: ½" CAB	Strontium Chromate	4
301-101-F	DC-805: ½" CAB	Calcium Chromate	4
301-101-G	General Electric SR-82: Formvar 7/70	Zinc Chromate	5
301-101-H	General Electric SR-82: Formvar 7/70	Strontium Chromate	5
301-101-K	General Electric SR-82: Formvar 7/70	Calcium Chromate	5
301-102-A	Kel-F 800: Acryloid A-101	Zinc Chromate	N.T.
301-102-B	Kel-F 800: Acryloid A-101	Strontium Chromate	N.T.
301-102-C	Kel-F 800: Acryloid A-101	Calcium Chromate	N.T.

Table 37 (continued)

Bimetallic Corrosion Testing of Primers

Primer Code	Primer Vehicle	Pigment	Rating
301-102-D	Kel-F Fluorel: Acryloid A-101	Zinc Chromate	3
301-102-E	Kel-F Fluorel: Acryloid A-101	Strontium Chromate	3
301-102-F	Kel-F Fluorel: Acryloid A-101	Calcium Chromate	3
301-102-G	Dow Corning R-6-0031: Bakelite BRS-2600	Zinc Chromate	5
301-102-H	Dow Corning R-6-0031: Bakelite BRS-2600	Strontium Chromate	5
301-102-K	Dow Corning R-6-0031: Bakelite BRS-2600	Calcium Chromate	5
301-103-A	Midland R-55: Plaskon ST-847	Zinc Chromate	2
301-103-B	Midland R-55: Plaskon ST-847	Strontium Chromate	3
301-103-C	Midland R-55: Plaskon ST-847	Calcium Chromate	4
301-104-A	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Zinc Chromate	5
301-104-B	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Strontium Chromate	5
301-104-C	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Calcium Chromate	5
301-106-A	Epon 1001: Versamid 115	Zinc Chromate	4
301-106-D	Epon 1001: Versamid 115	Strontium Chromate	5
301-106-G	Epon 1001: Versamid 115	Calcium Chromate	3
301-106-B	Epon 1001: Dow Corning Z-6020	Zinc Chromate	5
301-106-E	Epon 1001: Dow Corning Z-6020	Strontium Chromate	5
301-106-H	Epon 1001: Dow Corning Z-6020	Calcium Chromate	5
301-106-C	Epon 1001: Diethylene Triamine (DET)	Zinc Chromate	5
301-106-F	Epon 1001: Diethylene Triamine (DET)	Strontium Chromate	5
301-106-K	Epon 1001: Diethylene Triamine (DET)	Calcium Chromate	3

Table 37 (continued)

Bimetallic Corrosion Testing of Primers

Primer Code	Primer Vehicle	Pigment	Rating
301-107-A	Epon 1009: Versamid 115	Zinc Chromate	3
301-107-D	Epon 1009: Versamid 115	Strontium Chromate	5
301-107-G	Epon 1009: Versamid 115	Calcium Chromate	4
301-107-B	Epon 1009: Dow Corning Z-6020	Zinc Chromate	5
301-107-E	Epon 1009: Dow Corning Z-6020	Strontium Chromate	5
301-107-H	Epon 1009: Dow Corning Z-6020	Calcium Chromate	5
301-107-C	Epon 1009: Diethylene Triamine (DET)	Zinc Chromate	5
301-107-F	Epon 1009: Diethylene Triamine (DET)	Strontium Chromate	5
301-107-K	Epon 1009: Diethylene Triamine (DET)	Calcium Chromate	4
301-103-D	Roskydol 500	Zinc Chromate	G
301-103-E	Roskydol 500	Strontium Chromate	G
301-103-F	Roskydol 500	Calcium Chromate	G
301-125-A	Midland X-4209: Versamid 115	Zinc Chromate	5
301-125-C	Midland X-4209: Versamid 115	Strontium Chromate	5
301-125-E	Midland X-4209: Versamid 115	Calcium Chromate	5
301-125-B	Midland X-4209: Dow Corning Z-6020	Zinc Chromate	5
301-125-D	Midland X-4209: Dow Corning Z-6020	Strontium Chromate	5
301-125-F	Midland X-4209: Dow Corning Z-6020	Calcium Chromate	5
301-125-G	Dow Corning XR-6-0000: Versamid 115	Zinc Chromate	5
301-125-K	Dow Corning XR-6-0000: Versamid 115	Strontium Chromate	5
301-131-B	Dow Corning XR-6-0000: Versamid 115	Calcium Chromate	2
301-125-H	Dow Corning XR-6-0000: Dow Corning Z-6020	Zinc Chromate	5
301-131-A	Dow Corning XR-6-0000: Dow Corning Z-6020	Strontium Chromate	5
301-131-C	Dow Corning XR-6-0000: Dow Corning Z-6020	Calcium Chromate	5

Bimetallic Corrosion Rating System

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 38

Bimetallic Corrosion Testing of Primers Containing Extender Pigments

Primer Code	Primer Vehicle	Pigment Composition	Rating
301-100-D	Dow Corning R-6-0031: ½" Nitrocellulose	100% Zinc Chromate	5
301-123-G	Dow Corning R-6-0031: ½" Nitrocellulose	(87% Zinc Chromate	5
		(8% Talc	
		(5% Clay	
301-100-E	Dow Corning R-6-0031: ½" Nitrocellulose	100% Strontium Chromate	5
301-123-H	Dow Corning R-6-0031: ½" Nitrocellulose	(87% Strontium Chromate	5
		(8% Talc	
		(5% Clay	
301-100-F	Dow Corning R-6-0031: ½" Nitrocellulose	100% Calcium Chromate	5
301-123-K	Dow Corning R-6-0031: ½" Nitrocellulose	(87% Calcium Chromate	5
		(8% Talc	
		(5% Clay	
301-101-D	Dow Corning DC-805: ½" CAB	100% Zinc Chromate	3
301-124-A	Dow Corning DC-805: ½" CAB	(87% Zinc Chromate	4
		(8% Talc	
		(5% Clay	
301-101-E	Dow Corning DC-805: ½" CAB	100% Strontium Chromate	4
301-124-B	Dow Corning DC-805: ½" CAB	(87% Strontium Chromate	5
		(8% Talc	
		(5% Clay	
301-101-F	Dow Corning DC-805: ½" CAB	100% Calcium Chromate	4
301-124-C	Dow Corning DC-805: ½" CAB	(87% Calcium Chromate	5
		(8% Talc	
		(5% Clay	

Table 38 (continued)

Bimetallic Corrosion Testing of Primers Containing Extender Pigments

Primer Code	Primer Vehicle	Pigment Composition	Rating
301-103-A	Midland R-55: Plaskon ST-847	100% Zinc Chromate	2
301-124-G	Midland R-55: Plaskon ST-847	(87% Zinc Chromate (8% Talc (5% Clay	4
301-124-H	Midland R-55: Plaskon ST-847	(74% Zinc Chromate (16% Talc (10% Clay	4
301-124-K	Midland R-55: Plaskon ST-847	(61% Zinc Chromate (24% Talc (15% Clay	4

Bimetallic Corrosion Rating System

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

F. Salt Spray Exposure of Primers

Panels coated with the initial primers were tested in 5% salt spray at the same time they were being evaluated for galvanic corrosion resistance. Throughout most of the contract, this simultaneous exposure was conducted. The coating thickness on the salt spray panels was the same as the bimetallic corrosion panels. All salt spray panels were scribed to the bare metal down the center of the panel. For results of salt spray exposure of the primers, see Tables 39 and 40. (See fig. 6)

It should be noted that all salt spray results, unless otherwise stated, represent the entire panel, not only the scribed portion of the panel. When different results occur on the panel and on the scribe, a semicolon is used. For example:

> Many small blisters; many small blisters, slight corrosion on scribe.

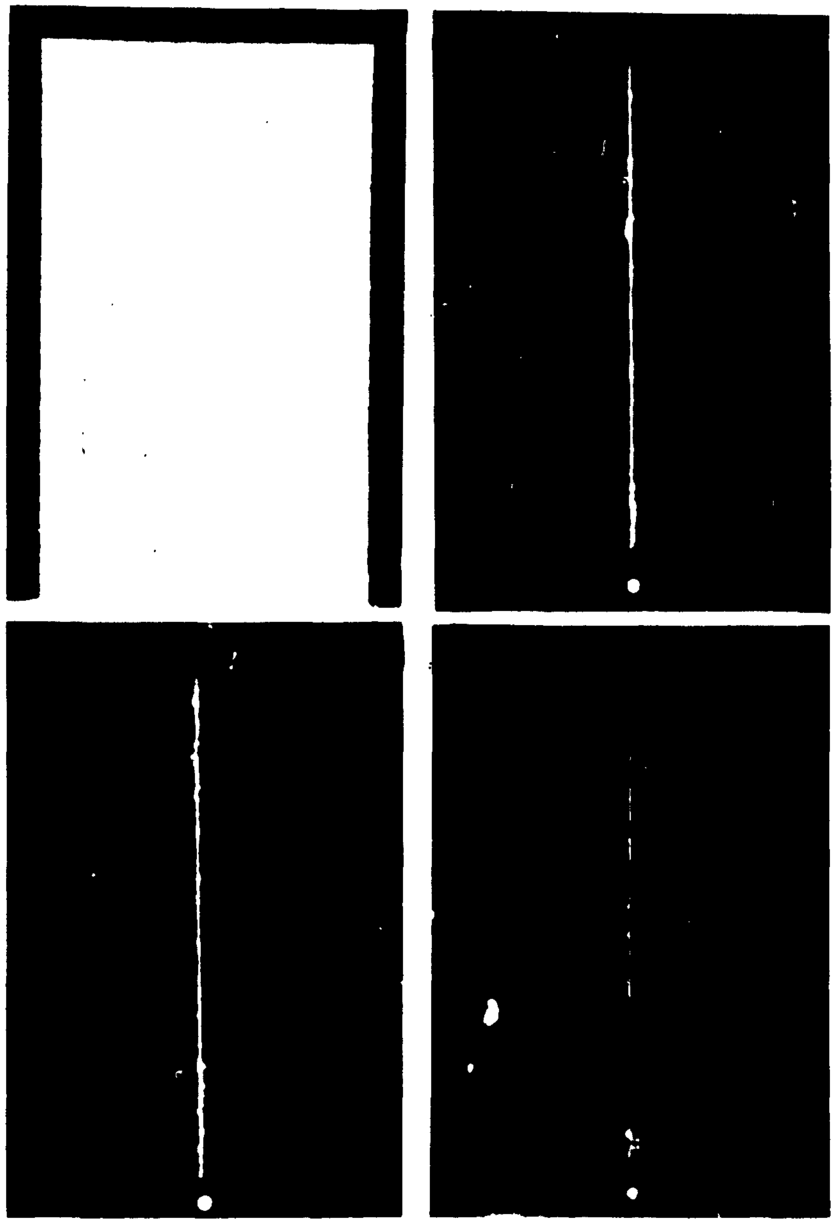
indicates the following were present:

(1) many small blisters on panel.

(2) many small blisters on scribe.

(3) slight corrosion on scribe.

FIG. 6



VARYING RESULTS IN 5% SALT SPRAY. PERFECT IN UPPER LEFT, TO MANY BLISTERS LOWER RIGHT

Fig. 6

TYPICAL 5% SALT SPRAY TEST RESULTS

Table 39

5% Salt Spray Testing of Primers

Primer Code	Results	Hours Tested
301-100-A	One large and some small blisters, cracking and lifting	800
301-100-B	One medium blister, some fading, slight corrosion	1600
301-100-C	Severe blistering	1400
301-100-D	Many blisters, some cracking and peeling	200
301-100-E	Some medium blisters, slight lifting and fading	1400
301-100-F	Some small blisters, slight lifting, cracking, and corrosion	1000
301-100-G	Severe blistering	400
301-100-H	Some medium and large blisters, some fading	800
301-100-K	Few medium blisters, some lifting and corrosion	2000
301-101-A	Severe blistering, slight lifting	800
301-101-B	Some small blisters, some lifting and fading	1600
301-101-C	Severe blistering	1200
301-101-D	Severe blistering, slignt lifting	1400
301-101-E	Many small blisters	200
301-101-F	Some small and very few medium blisters, some lifting	1200
301-101-G	Severe blistering	200
301-101-H	Many small blisters, some corrosion	400
301-101-K	Many blisters	200
301-102-D	Many small and some medium blisters, some corrosion	400
301-102-E	Some very small blisters; slight corrosion on scribe	2000
301-102-F	Many very small blisters	2000

Table 39 (continued)

5% Salt Spray Testing of Primers

Primer Code	Results	Hours Tested
301-102-G	Some small blisters, slight corrosion	400
301-102-H	Some small blisters, many water spots	400
301-102-K	Some very small blisters, many water spots	400
301-103-A	Completely unaffected	2000
301-103-B	Completely unaffected	2000
301-103-C	Completely unaffected	2000
301-104-A	Many very small blisters	600
301-104-B	Many very small blisters	800
301-104-C	Few very small blisters	2000
301-106-A	Many blisters	200
301-106-D	Many blisters	1000
301-106-G	Completely unaffected	2000
301-106-B	Some very small blisters; some corrosion on scribe	600
301-106-E	Some fading	2000
301-106-H	Completely unaffected	2000
301-106-C	Severe fading; some corrosion on scribe	1200
301-106-F	Three medium blisters, slight corrosion, completely faded	1400
301-106-K	Many small and one medium blister	600
301-107-A	Many small blisters, slight corrosion	600
301-107-D	Severe blistering and fading	800
301-107-G	Some blistering	1400

Table 39 (continued)

5% Salt Spray Testing of Primers

Primer Code	Results	Hours Tested
301-107-B	Many small blisters; slight corrosion on scribe	600
301-107-E	Few small blisters, slight corrosion and fading	1000
301-107-H	Few small and very small blisters	800
301-107-C	Few small and medium blisters; slight corrosion on scribe	1000
301-107-F	Severe blistering and fading	600
301-107-K	Many small blisters	1400
301-125-A	Very slight corrosion	2000
301-125-C	Few small blisters, slight lifting and fading	2000
301-125-E	Few very small blisters, many very small blisters on scribe	2000
301-125-B	Severe blistering	600
301-125-D	Many small blisters, slight lifting and corrosion	1600
301-125-F	Few very small blisters on scribe; some fading	2000
301-125-G	Many small blisters	600
301-125-K	Many small blisters	600
301-131-B	Some small blisters	2000
301-125-H	Few very small blisters, very slight lifting	2000
301-131-A	Some small blisters, slight lifting and corrosion	2000
301-131-C	Slight corrosion on scribe	2000

Table 40

5% Salt Spray Testing of Primers Containing Extender Pigments

Primer Code	Results	Hours Tested
301-100-D	Many blisters, some cracking and peeling	200
301-123-G	Not Tested	-
301-100-E	Some medium blisters, slight lifting and fading	1400
301-123-H	Not Tested	-
301-100-F	Some small blisters, slight lifting, cracking, and corrosion	1000
301-123-K	Not Tested	-
301-101-D	Severe blistering, slight lifting	1400
301-124-A	Severe blistering	400
301-101-E	Many small blisters	200
301-124-B	Severe blistering	400
301-101-F	Some small and very few medium blisters, some lifting	1200
301-124-C	Many small blisters	600
301-103-A	Completely unaffected	2000
301-124-G	Completely unaffected	2000
301-124-H	Completely unaffected	2000
301-124-K	Completely unaffected	2000

Section V

Development of Olive Drab Topcoat

A. Initial Vehicles Used

The vehicles used for preparation of olive drab topcoats were the same as those used for the primers. The complete list can be found in part A of the primer section.

B. Pigmentation

The following pigmentation was used to obtain the #2430 olive drab color and 15-25° gloss:

Pigment	% by weight
Medium chrome yellow	31.6
Red lead	16.7
Zinc oxide	9.1
Red iron oxide	12.3
Lampblack	6.0
Titanium dioxide	10.9
Clay	2.7
Diatomaceous earth	10.7
	100.0%

Coatings containing unmodified silicone resins did not include the red lead because of the reactivity of those resins with lead. A pigment content of 65% by weight was used. No attempt was made to shade these coatings to match the #2430 color chip nor was the gloss of any coating adjusted.

C. Preparation of Panels

The Dow 17 treated HK-31 magnesium panels were primed with 0.0015 inches of primer and allowed to age a minimum of 7 days. The same thickness of topcoat was applied and the panels were aged for 7 more days before testing. Each coating was crosshatched with a stylus and the adhesion tested with cellulose tape. The tape was firmly applied to the crosshatched section and then removed from the panel in one rapid motion. See Table 41 for adhesion rating key. (See fig. 7)

D. Bimetallic Corrosion and Salt Spray Testing

The bimetallic corrosion and salt spray testing of the complete coating systems were conducted in the same manner as those tests were performed on the primers alone.

The following systems were judged to be the best coatings at this point in the work:

	Primer	Topcoat
1.	301-103-A	301-115-A
2.	301-131-B	301-115-A
3.	301-131-B	301-114-C
4.	301-103-A	301-134-A
5.	301-103-A	301-134-C
6.	301-131-B	301-134-C
7.	301-131-B	301-118-F

For results of salt spray and bimetallic corrosion testing of the olive drab coating systems, see Tables 42 and 43.

FIG. 7

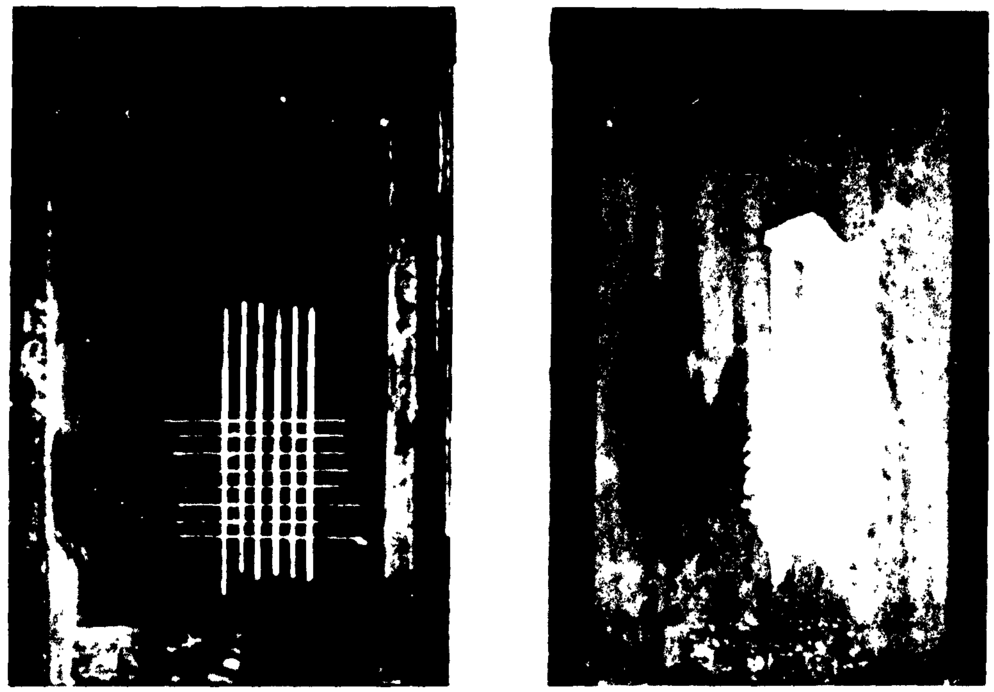


Fig. 7

EXAMPLES OF GOOD AND POOR ADHESION

Table 41

Adhesion Rating System

In all complete coating systems (primer plus topcoat), the coating was crosshatched to bare metal and the adhesion was tested with cellulose tape. The tape was firmly applied to the crosshatched section and then removed from the panel in one rapid motion. The following rating system was used:

Rating	Description	Rating	Description
0	Excellent Adhesion	0	Excellent Adhesion
1	Less than 10% failure, topcoat from primer	1P	Less than 10% failure, primer from substrate
2	10-25% failure, topcoat from primer	2P	10-25% failure, primer from substrate
3	25-50% failure, topcoat from primer	3P	25-50% failure, primer from substrate
4	50-75% failure, topcoat from primer	4P	50-75% failure, primer from substrate
5	Complete lifting of topcoat from primer	5P	Complete lifting of primer from substrate

Table 42

Bimetallic Corrosion Testing of Olive Drab Coating Systems

Primer Code	Topcoat Code	Topcoat Vehicle	Rating
301-103-A	301-112-A	Midland R-62: ½" RS Nitrocellulose	N.T.
301-101-D	301-112-A	Midland R-62: ½" RS Nitrocellulose	5
301-131-B	301-112-A	Midland R-62: ½" RS Nitrocellulose	3
301-103-A	301-112-B	Dow Corning R-6-0031: ½" RS Nitrocellulose	N.T.
301-101-D	301-112-B	Dow Corning R-6-0031: ½" RS Nitrocellulose	5
301-131-B	301-112-B	Dow Corning R-6-0031: ½" RS Nitrocellulose	4
301-103-A	301-112-C	Plaskon ST-856: ½" RS Nitrocellulose	N.T.
301-101-D	301-112-C	Plaskon ST-856: ½" RS Nitrocellulose	4
301-131-B	301-112-C	Plaskon ST-856: ½" RS Nitrocellulose	4
301-103-A	301-113-A	Dow Corning DC-803: ½" CAB	N.T.
301-101-D	301-113-A	Dow Corning DC-803: ½" CAB	5
301-131-B	301-113-A	Dow Corning DC-803: ½" CAB	5
301-103-A	301-113-B	Dow Corning DC-805: ½" CAB	5
301-101-D	301-113-B	Dow Corning DC-805: ½" CAB	4
301-131-B	301-113-B	Dow Corning DC-805: ½" CAB	3
301-103-A	301-113-C	General Electric SR-82: Formvar 7/70	3
301-101-D	301-113-C	General Electric SR-82: Formvar 7/70	N.T.
301-131-B	301-113-C	General Electric SR-82: Formvar 7/70	3
301-103-A	301-114-A	Kel-F 800: Acryloid A-101	N.T.
301-101-D	301-114-A	Kel-F 800: Acryloid A-101	N.T.
301-131-B	301-114-A	Kel-F 800: Acryloid A-101	N.T.
--	301-114-B	Kel-F Fluorel: Acryloid A-101	G

Table 42 (continued)

Bimetallic Corrosion Testing of Olive Drab Coating Systems

Primer Code	Topcoat Code	Topcoat Vehicle	Rating
301-103-A	301-114-C	Dow Corning R-6-0031: Bakelite BRS-2600	3
301-101-D	301-114-C	Dow Corning R-6-0031: Bakelite BRS-2600	5
301-131-B	301-114-C	Dow Corning R-6-0031: Bakelite BRS-2600	1
301-103-A	301-115-A	Midland R-55: Plaskon ST-847	0
301-101-D	301-115-A	Midland R-55: Plaskon ST-847	2
301-131-B	301-115-A	Midland R-55: Plaskon ST-847	1
--	301-115-B	Roskydol 500	G
301-103-A	301-117-A	Epon 1001: Versamid 115	2
301-101-D	301-117-A	Epon 1001: Versamid 115	2
301-131-B	301-117-A	Epon 1001: Versamid 115	2
301-103-A	301-117-B	Epon 1001: Dow Corning Z-6020	2
301-101-D	301-117-B	Epon 1001: Dow Corning Z-6020	2
301-131-B	301-117-B	Epon 1001: Dow Corning Z-6020	2
301-103-A	301-117-C	Epon 1001: Diethylene Triamine (DET)	3
301-101-D	301-117-C	Epon 1001: Diethylene Triamine (DET)	4
301-131-B	301-117-C	Epon 1001: Diethylene Triamine (DET)	5
301-103-A	301-117-D	Epon 1009: Versamid 115	5
301-101-D	301-117-D	Epon 1009: Versamid 115	4
301-131-B	301-117-D	Epon 1009: Versamid 115	2
301-103-A	301-117-E	Epon 1009: Dow Corning Z-6020	2
301-101-D	301-117-E	Epon 1009: Dow Corning Z-6020	5
301-131-B	301-117-E	Epon 1009: Dow Corning Z-6020	2

Table 42 (continued)

Bimetallic Corrosion Testing of Olive Drab Coating Systems

Primer Code	Topcoat Code	Topcoat Vehicle	Rating
301-103-A	301-117-F	Epon 1009: Diethylene Triamine (DET)	3
301-101-D	301-117-F	Epon 1009: Diethylene Triamine (DET)	5
301-131-B	301-117-F	Epon 1009: Diethylene Triamine (DET)	5
301-103-A	301-134-A	Midland X-4209: Versamid 115	1
301-101-D	301-134-A	Midland X-4209: Versamid 115	2
301-131-B	301-134-A	Midland X-4209: Versamid 115	2
301-103-A	301-134-B	Midland X-4209: Dow Corning Z-6020	N.T.
301-101-D	301-134-B	Midland X-4209: Dow Corning Z-6020	5
301-131-B	301-134-B	Midland X-4209: Dow Corning Z-6020	5
301-103-A	301-134-C	Dow Corning XR-6-0000: Versamid 115	2
301-101-D	301-134-C	Dow Corning XR-6-0000: Versamid 115	2
301-131-B	301-134-C	Dow Corning XR-6-0000: Versamid 115	2
301-103-A	301-134-D	Dow Corning XR-6-0000: Dow Corning Z-6020	4
301-101-D	301-134-D	Dow Corning XR-6-0000: Dow Corning Z-6020	5
301-131-B	301-134-D	Dow Corning XR-6-0000: Dow Corning Z-6020	2
301-103-A	301-118-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	2
301-101-D	301-118-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	N.T.
301-131-B	301-118-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	0

Bimetallic Corrosion Rating System

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 43

5% Salt Spray Testing of Olive Drab Coating Systems

Primer Code	Topcoat Code	Adhesion	Results	Hours Tested
301-103-A	301-112-A	-	Not Tested	-
301-101-D	301-112-A	2	Some small blisters; lifting on scribe	800
301-131-B	301-112-A	0	Very few small blisters, slight lifting and corrosion	1600
301-103-A	301-112-B	-	Not Tested	-
301-101-D	301-112-B	2P	Some small and one medium blister, cracking and slight corrosion	800
301-131-B	301-112-B	0	Very few very small blisters; corrosion and few small blisters on scribe	1600
301-103-A	301-112-C	-	Not Tested	-
301-101-D	301-112-C	2P	Few small blisters, cracking and discoloration	800
301-131-B	301-112-C	0	Few small blisters, slight lifting; some corrosion on scribe	2000
301-103-A	301-113-A	-	Not Tested	-
301-101-D	301-113-A	2P	Some small blisters	800
301-131-B	301-113-A	4	Slight corrosion and lifting; few small blisters on scribe	2000
301-103-A	301-113-B	1P	Few medium blisters, slight discoloration; corrosion on scribe	2000
301-101-D	301-113-B	2	Many small blisters, slight discoloration	800
301-131-B	301-113-B	0	Few small blisters and slight corrosion on scribe	2000
301-103-A	301-113-C	1P	Some medium blisters, slight discoloration; slight corrosion on scribe	2000
301-101-D	301-113-C	-	Not Tested	-
301-131-B	301-113-C	0	Slight lifting and corrosion; few small blisters on scribe	2000
301-103-A	301-114-C	0	Cracking and discoloration; few small blisters and slight corrosion on scribe	2000
301-101-D	301-114-C	0	Many blisters, slight discoloration; slight corrosion on scribe	2000
301-131-B	301-114-C	0	Very few small blisters and slight corrosion on scribe	2000

Table 43 (continued)

5% Salt Spray Testing of Olive Drab Coating Systems

Primer Code	Topcoat Code	Adhesion	Results	Hours Tested
301-103-A	301-115-A	5	Slight corrosion and one medium blister on scribe	2000
301-101-D	301-115-A	5	Many small blisters	800
301-131-B	301-115-A	2	Very slight lifting along scribe	2000
301-103-A	301-117-A	2P	Very few small blisters, slight lifting and discoloration	2000
301-101-D	301-117-A	4	Many blisters and slight lifting	1800
301-131-B	301-117-A	1	Discoloration, slight corrosion; slight lifting on scribe	2000
301-103-A	301-117-B	2P	Discoloration; few medium blisters and slight corrosion on scribe	2000
301-101-D	301-117-B	5	Discoloration; slight lifting on scribe	2000
301-131-B	301-117-B	0	Slight corrosion; few small blisters and slight lifting on scribe	2000
301-103-A	301-117-C	1P	Discoloration, many small blisters, lifting, corrosion	1800
301-101-D	301-117-C	1P	Many small blisters	600
301-131-B	301-117-C	0	Slight corrosion; few small blisters and slight lifting on scribe	2000
301-103-A	301-117-D	5	Many small blisters	600
301-101-D	301-117-D	4P	Cracking, slight discoloration	1600
301-131-B	301-117-D	0	Slight corrosion and discoloration; many very small blisters on scribe	2000
301-103-A	301-117-E	4P	Many small blisters	600
301-101-D	301-117-E	4	Many small blisters	600
301-131-B	301-117-E	1	Few small blisters and slight corrosion; very slight lifting and discoloration on scribe	2000
301-103-A	301-117-F	4P	Many very small blisters, cracking, discoloration	1600
301-101-D	301-117-F	4	Many small blisters	600
301-131-B	301-117-F	0	Slight lifting, discoloration, and corrosion; few small blisters on scribe	2000

Table 43 (continued)

5% Salt Spray Testing of Olive Drab Coating Systems

Primer Code	Topcoat Code	Adhesion	Results	Hours Tested
301-103-A	301-134-A	0	Few small blisters and slight lifting on scribe	2000
301-101-D	301-134-A	5	Few small blisters, slight discoloration	2000
301-131-B	301-134-A	0	Very slight lifting and few very small blisters on scribe	2000
301-103-A	301-134-B	-	Not Tested	-
301-101-D	301-134-B	3	Discoloration, few small blisters; slight corrosion on scribe	1800
301-131-B	301-134-B	0	Very slight corrosion and slight lifting; discoloration and very few very small blisters on scribe	2000
301-103-A	301-134-C	1P	Lifting, slight discoloration, many very small and two small blisters; few small blisters on scribe	2000
301-101-D	301-134-C	4	Three medium blisters, slight lifting	1200
301-131-B	301-134-C	0	Very slight lifting; very few very small blisters and slight corrosion on scribe	2000
301-103-A	301-134-D	2P	Cracking, slight discoloration, and lifting; slight corrosion on scribe	1200
301-101-D	301-134-D	5	Very few small blisters, cracking, slight lifting and discoloration	1600
301-131-B	301-134-D	0	Discoloration; slight lifting and corrosion on scribe	2000
301-103-A	301-118-F	4	Many very small blisters and slight lifting	2000
301-101-D	301-118-F	-	Not Tested	-
301-131-B	301-118-F	0	Very few blisters, very slight lifting and corrosion, all on scribe	2000

Adhesion Rating System

Rating	Description	Rating	Description
0	Excellent Adhesion	0	Excellent Adhesion
1	Less than 10% failure, topcoat from primer	1P	Less than 10% failure, primer from substrate
2	10-25% failure, topcoat from primer	2P	10-25% failure, primer from substrate
3	25-50% failure, topcoat from primer	3P	25-50% failure, primer from substrate
4	50-75% failure, topcoat from primer	4P	50-75% failure, primer from substrate
5	Complete lifting of topcoat from primer	5P	Complete lifting of primer from substrate

Section VI

Development of White Topcoat

A. Initial Vehicles Used

The vehicles found in Part A of the primer section were used to prepare white topcoats. One resin system, the combination of Dow Corning R-6-0031 and Bakelite BRS-2600, was not used because of its dark color.

B. Pigmentation

The pigment chosen for the white topcoats was sulfate-process rutile titanium dioxide. The coatings were flatted to the approximate gloss required with talc. A 53% pigment content by weight was used.

C. Preparation of Panels

The same procedure used for preparation of olive drab coating systems was followed with the white systems. Only the 301-103-A and 301-131-B primers were used.

D. Bimetallic Corrosion and Salt Spray Testing

Bimetallic corrosion and salt spray tests were conducted in the usual manner.

Although the white coating systems were generally inferior in performance to the olive drab systems, the following were considered to have performed well enough to merit additional testing:

	Primer	Topcoat
1.	301-103-A	301-164-D
2.	301-131-B	301-163-F
3.	301-131-B	301-183-B
4.	301-103-A	301-183-D
5.	301-103-A	301-210-A

For results of salt spray and bimetallic corrosion testing of white coating systems, see Tables 44 and 45.

Table 44

Bimetallic Corrosion Testing of White Coating Systems

Primer Code	Topcoat Code	Topcoat Vehicle	Rating
301-103-A	301-163-A	Midland R-62: ½" RS Nitrocellulose	2
301-131-B	301-163-A	Midland R-62: ½" RS Nitrocellulose	3
301-103-A	301-163-B	Dow Corning R-6-0031: ½" RS Nitrocellulose	3
301-131-B	301-163-B	Dow Corning R-6-0031: ½" RS Nitrocellulose	3
301-103-A	301-163-C	Plaskon ST-856: ½" RS Nitrocellulose	3
301-131-B	301-163-C	Plaskon ST-856: ½" RS Nitrocellulose	5
301-103-A	301-163-D	Dow Corning DC-803: ½" CAB	3
301-131-B	301-163-D	Dow Corning DC-803: ½" CAB	3
301-103-A	301-163-F	Dow Corning DC-805: ½" CAB	3
301-131-B	301-163-F	Dow Corning DC-805: ½" CAB	2
301-103-A	301-163-E	General Electric SR-82: Formvar 7/70	2
301-131-B	301-163-E	General Electric SR-82: Formvar 7/70	2
301-103-A	301-164-A	Kel-F 800: Acryloid A-101	N.T.
301-131-B	301-164-A	Kel-F 800: Acryloid A-101	N.T.
--	301-164-B	Kel-F Fluorel: Acryloid A-101	G
301-103-A	301-164-D	Midland R-55: Plaskon ST-847	0
301-131-B	301-164-D	Midland R-55: Plaskon ST-847	2
--	301-164-E	Roskydol 500	G
301-103-A	301-183-A	Epon 1001: Versamid 115	2
301-131-B	301-183-A	Epon 1001: Versamid 115	4

Table 44 (continued)

Bimetallic Corrosion Testing of White Coating Systems

Primer Code	Topcoat Code	Topcoat Vehicle	Rating
301-103-A	301-183-B	Epon 1001: Dow Corning Z-6020	3
301-131-B	301-183-B	Epon 1001: Dow Corning Z-6020	1
301-103-A	301-183-C	Epon 1001: Diethylene Triamine (DET)	4
301-131-B	301-183-C	Epon 1001: Diethylene Triamine (DET)	4
301-103-A	301-183-F	Epon 1009: Versamid 115	4
301-131-B	301-183-F	Epon 1009: Versamid 115	4
301-103-A	301-183-G	Epon 1009: Dow Corning Z-6020	5
301-131-B	301-183-G	Epon 1009: Dow Corning Z-6020	5
301-103-A	301-183-H	Epon 1009: Diethylene Triamine (DET)	5
301-131-B	301-183-H	Epon 1009: Diethylene Triamine (DET)	5
301-103-A	301-183-D	Midland X-4209: Versamid 115	2
301-131-B	301-183-D	Midland X-4209: Versamid 115	2
301-103-A	301-183-E	Midland X-4209: Dow Corning Z-6020	2
301-131-B	301-183-E	Midland X-4209: Dow Corning Z-6020	3
301-103-A	301-210-A	Dow Corning XR-6-0000: Versamid 115	2
301-131-B	301-210-A	Dow Corning XR-6-0000: Versamid 115	2
301-103-A	301-210-B	Dow Corning XR-6-0000: Dow Corning Z-6020	2
301-131-B	301-210-B	Dow Corning XR-6-0000: Dow Corning Z-6020	4
301-103-A	301-182-B	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	3
301-131-B	301-182-B	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	3

Bimetallic Corrosion Rating System

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N. T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 45

5% Salt Spray Testing of White Coating Systems

Primer Code	Topcoat Code	Adhesion	Results	Hours Tested
301-103-A	301-163-A	5	Completely unaffected	2000
301-131-B	301-163-A	0	Many very small blisters and very slight corrosion on scribe	2000
301-103-A	301-163-B	3	Severe cracking	200
301-131-B	301-163-B	0	Completely unaffected	2000
301-103-A	301-163-C	-	Not Tested	-
301-131-B	301-163-C	0	Very slight corrosion on scribe	2000
301-103-A	301-163-D	0	Very few very small blisters and very slight corrosion on scribe	2000
301-131-B	301-163-D	0	Few very small blisters and very slight corrosion on scribe	2000
301-103-A	301-163-F	1	Very slight corrosion and lifting on scribe	2000
301-131-B	301-163-F	1	Many very small blisters	1000
301-103-A	301-163-E	4	Many small blisters and slight corrosion on scribe	2000
301-131-B	301-163-E	3	Very slight corrosion on scribe	2000
301-103-A	301-164-D	5	Yellowing; one small blister and very slight corrosion on scribe	2000
301-131-B	301-164-D	5	Yellowing; few very small blisters and slight corrosion on scribe	2000
301-103-A	301-183-A	0	Few small blisters; very slight corrosion on scribe	2000
301-131-B	301-183-A	0	Many very small blisters; very slight corrosion and lifting on scribe	2000
301-103-A	301-183-B	1	Completely unaffected	2000
301-131-B	301-183-B	0	Very slight corrosion on scribe	2000
301-103-A	301-183-C	0	Many small blisters	200
301-131-B	301-183-C	0	Many very small blisters and slight corrosion on scribe	2000

Table 45 (continued)

5% Salt Spray Testing of White Coating Systems

Primer Code	Topcoat Code	Adhesion	Results	Hours Tested
301-103-A	301-183-F	2	Many very small blisters; few small blisters and very slight corrosion on scribe	2000
301-131-B	301-183-F	0	Many small blisters	200
301-103-A	301-183-G	3	Severely cracked	200
301-131-B	301-183-G	5	Few small blisters; very slight corrosion and slight lifting on scribe	2000
301-103-A	301-183-H	0	Many very small blisters and slight cracking; slight lifting and corrosion on scribe	1600
301-131-B	301-183-H	0	Slight corrosion on scribe	2000
301-103-A	301-183-D	0	Few small blisters, very slight corrosion and slight lifting, all on scribe	2000
301-131-B	301-183-D	0	Few very small blisters and slight corrosion on scribe	2000
301-103-A	301-183-E	0	Few very small blisters and moderate corrosion on scribe	2000
301-131-B	301-183-E	0	Few small blisters; slight corrosion on scribe	2000
301-103-A	301-210-A	2	Many very small blisters; very slight corrosion on scribe	2000
301-131-B	301-210-A	0	Many very small blisters and very slight corrosion on scribe	2000
301-103-A	301-210-B	2	Yellowed, few very small blisters; few small blisters and slight corrosion on scribe	2000
301-131-B	301-210-B	0	Yellowed; very slight corrosion on scribe	2000
301-103-A	301-182-B	5	Many very small blisters; few small blisters, slight corrosion and slight lifting, all on scribe	2000
301-131-B	301-182-B	0	Few very small blisters and slight corrosion on scribe	2000

Adhesion Rating System

Rating	Description	Rating	Description
0	Excellent Adhesion	0	Excellent Adhesion
1	Less than 10% failure, topcoat from primer	1P	Less than 10% failure, primer from substrate
2	10-25% failure, topcoat from primer	2P	10-25% failure, primer from substrate
3	25-50% failure, topcoat from primer	3P	25-50% failure, primer from substrate
4	50-75% failure, topcoat from primer	4P	50-75% failure, primer from substrate
5	Complete lifting of topcoat from primer	5P	Complete lifting of primer from substrate

Section VII

Epoxy Ester and Silicone Epoxy Ester Coatings

A. 301-103-A Primer

This primer, containing a blend of Midland R-55 epoxy ester and Plaskon ST-847 silicone-epoxy ester copolymer was one of the two best primers for inhibiting galvanic corrosion. However, it did not provide good adhesion for most topcoats. The following were tried in an attempt to improve this property:

1. The drier content was increased and decreased.
2. The time between applying the primer and applying the topcoat was varied.
3. The topcoats were reduced with methyl isobutyl ketone to try to soften the primer just enough to provide better adhesion.
4. The pigment volume concentration of the topcoats was increased and decreased.

None of the above was successful with the exception of topcoating within 24 hours after applying the primer. This was believed to be too impractical to merit further consideration.

B. Preparation and Testing of New Vehicles

Since primer 301-103-A was a blend of an epoxy ester and a silicone-epoxy ester copolymer, it was thought that a silicone-epoxy ester copolymer approximately equal to the blend in composition might have some properties superior to the blend. For this reason, the following resins were prepared:

Code	Epoxy	Fatty Acid	Silicone
X-4235	40% Epon 1001	30% Linseed	30% Dow Corning Z-6018
X-4237	49% Epon 1001	36% Tall	15% Dow Corning Z-6018
X-4238	49% Epon 1001	36% Linseed	15% Dow Corning Z-6018
X-4240	49% Epon 1001	36% DCO	15% Dow Corning Z-6018
X-4241	51% Epon 1001	39% Linseed	10% Dow Corning Z-6018
X-4243	51% Epon 1001	39% Tall	10% Dow Corning Z-6018
X-4245	51% Epon 1001	39% DCO	10% Dow Corning Z-6018
X-4253	49% Epon 1001	36% DCO	15% Dow Corning Sylkyd 50
X-4255	51% Epon 1001	39% DCO	10% Dow Corning Sylkyd 50
X-4257	49% Epon 1001	36% DCO	15% Dow Corning XZ-6088
X-4263	49% Epon 1001	36% Safflower	15% Dow Corning Z-6018
X-4266	51% Epon 1001	39% Safflower	10% Dow Corning Z-6018
X-4271	49% D.E.R. 661	36% Safflower	15% Dow Corning Z-6018
X-4278	49% Epon 1001	36% Soya	15% Dow Corning Z-6018
X-4282	49% D.E.R. 661	36% DCO	15% Dow Corning Z-6018
X-4283	49% Araldite 6071	36% DCO	15% DowCorning Z-6018
X-4295	49% Epon 1001	36% DCO	15% Dow Corning Z-6018
X-4296	49% Epon 1007	36% DCO	15% Dow Corning Z-6018
X-4300	49% Epon 1001	36% DCO	15% Union Carbide XR-820

The silicone-epoxy ester copolymers were prepared in the following manner:

1. The fatty acid was heated to approximately the melting point of the epoxy resin. For epoxy resins with epoxide equivalent weights of 500, the temperature was 210-250°F. For epoxies with epoxide equivalent weights of 900-1,000 and 2,000-2,500, the temperatures to which the fatty acids were heated were 300 F and 350 F, respectively. In some cases, a catalytic quantity of triphenyl phosphite was added after the fatty acids reached the desired temperature. A blow of inert gas was used throughout the cook.

2. The epoxy resin was added and the mixture was blown at 520°F for 1 hour. The acid number would be in the range of 1-5 after this time.

3. The temperature was lowered to 400°F and the silicone intermediate and a portion of the solvent was added. Some octoic acid was added as a catalyst when Dow Corning Sylkyd 50 and Union Carbide XR-620 were used. The material was refluxed about 10 hours or until viscous. The remainder of the solvent was added.

In addition some counterparts of Midland R-55 were prepared to determine the effect of different oils on the performance of this resin. Midland X-3540, X-3548, and X-4334 contained linseed, DCO, and soya fatty acids, respectively. The following commercial epoxy esters were also evaluated:

1. Reichhold Epotuf 6401
2. Jones-Dabney Epitex 120
3. Jones-Dabney Epitex 1241
4. Jones-Dabney Epitex 1486
5. Midland R-2

C. Screening of Clear Resins

The epoxy esters and the silicone-epoxy ester copolymers mentioned above were screened in clear coatings by themselves and, when indicated, in combination with each other. The results of this testing can be found in Table 46. All coatings made from the same resin differ only in drier content. The following ratio of driers (based on metal content by weight) was used throughout.

3 parts cobalt

4 parts calcium

2 parts rare earth

D. Epoxy Ester Primers

Since the pigment level chosen for evaluation of the primers was set at 35% by weight only on the basis of previous work in this field, a study of the effect of pigment concentration on corrosion resistance was undertaken. The Midland R-55: Plaskon ST-847 vehicle was chosen for this work and the pigment content was varied from 0 to 65% by weight. It was found that the 35% pigment level was as good a choice as could be made. For bimetallic corrosion and salt spray testing of these coatings, see Tables 47 and 48. (See fig. 8)

Table 46

Screening Epoxy Ester Resins

Coatings Made from Same Resin Combination Differ Only in Drier Content.

Code	Resin	Drier Content	Air Dried Film		30 min. @500F.		2 hrs. @500F.		MIL-S-3136 Fluid		Lubricant	
			Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-119-A	X-4237	0.090%	1	2	2	O.K.	2	O.K.	S	YES	S	NO
301-119-B	X-4237	0.060%	2	2	2	O.K.	2	O.K.	S	YES	S	NO
301-119-C	X-4237	0.030%	4	4	2	O.K.	2	O.K.	S	YES	S	NO
301-119-D	X-4238	0.090%	0	2	1	O.K.	1	O.K.	S	NO	S	NO
301-119-E	X-4238	0.060%	0	2	1	O.K.	1	O.K.	S	NO	D	-
301-119-F	X-4238	0.030%	0	3	1	O.K.	1	O.K.	D	-	S	NO
301-119-G	75% R-55:25% X-4235	0.090%	0	2	2	O.K.	2	O.K.	S	YES	S	YES
301-119-H	75% R-55:25% X-4235	0.060%	0	2	2	O.K.	2	O.K.	S	YES	S	YES
301-119-K	75% R-55:25% X-4235	0.030%	1	2	2	O.K.	2	O.K.	S	YES	S	YES
301-152-A	X-4240	0.090%	0	1	1	O.K.	1	O.K.	S	YES	U	-
301-152-B	X-4240	0.060%	0	1	1	O.K.	1	O.K.	S	YES	U	-
301-152-C	X-4240	0.030%	0	1	2	O.K.	1	O.K.	S	YES	U	-
301-152-D	X-4241	0.090%	1	3	2	O.K.	2	O.K.	S	NO	S	NO
301-152-E	X-4241	0.060%	2	3	2	O.K.	2	O.K.	S	NO	S	NO
301-152-F	X-4241	0.030%	2	3	2	O.K.	2	O.K.	S	NO	S	NO
301-152-G	X-4243	0.090%	1	2	2	N.G.	1	N.G.	S	YES	D	-
301-152-H	X-4243	0.060%	3	2	2	N.G.	1	N.G.	S	YES	D	-
301-152-K	X-4243	0.030%	5	3	3	N.G.	1	N.G.	S	YES	D	-
301-152-L	X-4245	0.090%	0	2	1	O.K.	1	O.K.	D	-	U	-
301-152-M	X-4245	0.060%	0	2	1	O.K.	1	O.K.	S	YES	U	-
301-152-N	X-4245	0.030%	0	2	1	O.K.	1	O.K	S	YES	U	-

Table 46 (continued)

Screening Epoxy Ester Resins

Code	Resin	Drier Content	Air Dried Film		30 min. @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
			Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-155-E	R-55	0.090%	0	2	1	O.K.	1	O.K.	D	-	U	-
301-155-F	R-55	0.060%	0	2	1	O.K.	1	O.K.	S	YES	U	-
301-155-G	R-55	0.030%	0	2	1	O.K.	1	O.K.	S	YES	U	-
301-165-A	X-4255	0.090%	1	3	1	O.K.	0	O.K.	S	YES	U	-
301-165-B	X-4255	0.060%	1	3	1	O.K.	0	O.K.	S	YES	U	-
301-165-C	X-4255	0.030%	1	3	1	O.K.	0	O.K.	S	YES	U	-
301-165-D	X-4253	0.090%	2	3	1	O.K.	0	O.K.	S	YES	U	-
301-165-E	X-4253	0.060%	1	3	1	O.K.	0	O.K.	S	YES	U	-
301-165-F	X-4253	0.030%	1	3	1	O.K.	0	O.K.	S	YES	U	-
301-165-G	X-4257	0.080%	1	2	1	O.K.	0	O.K.	D	-	U	-
301-165-H	X-4257	0.055%	1	2	1	O.K.	0	O.K.	D	-	S	NO
301-165-K	X-4257	0.025%	1	2	1	O.K.	0	O.K.	D	-	S	NO
301-161-A	X-4263	0.090%	0	2	1	O.K.	1	O.K.	S	YES	U	-
301-161-B	X-4263	0.060%	0	2	1	O.K.	1	O.K.	S	YES	U	-
301-161-C	X-4263	0.030%	0	2	1	O.K.	1	O.K.	S	YES	U	-
301-161-D	X-4266	0.090%	0	2	1	O.K.	1	O.K.	D	-	S	NO
301-161-E	X-4266	0.060%	0	2	1	O.K.	1	O.K.	D	-	U	-
301-161-F	X-4266	0.030%	0	2	1	O.K.	1	O.K.	D	-	S	NO
301-161-G	X-4271	0.090%	0	3	2	O.K.	2	O.K.	S	YES	U	-
301-161-H	X-4271	0.060%	0	3	2	O.K.	2	O.K.	S	YES	U	-
301-161-K	X-4271	0.030%	0	3	3	O.K.	2	O.K.	D	-	U	-

Table 46 (continued)

Screening Epoxy Ester Resins

Code	Resin	Drier Content	Air Dried Film		30 min. @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
			Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-161-L	X-4278	0.090%	1	2	2	O.K.	1	O.K.	S	YES	S	NO
301-161-M	X-4278	0.060%	1	1	2	O.K.	2	O.K.	D	-	D	-
301-161-N	X-4278	0.030%	1	1	2	O.K.	2	O.K.	D	-	D	-
301-189-A	X-4282	0.090%	1	3	3	O.K.	3	O.K.	S	YES	U	-
301-189-B	X-4282	0.060%	1	3	2	O.K.	3	O.K.	S	YES	U	-
301-189-C	X-4282	0.030%	1	2	2	O.K.	2	O.K.	S	YES	U	-
301-189-D	X-4283	0.090%	1	2	3	O.K.	3	O.K.	S	YES	U	-
301-189-E	X-4283	0.060%	2	2	2	O.K.	2	O.K.	S	YES	U	-
301-189-F	X-4283	0.030%	1	3	2	O.K.	3	O.K.	S	YES	U	-
301-189-G	X-4278	0.090%	1	3	3	O.K.	2	O.K.	D	-	S	NO
301-189-H	X-4278	0.060%	1	3	3	O.K.	2	O.K.	D	-	S	NO
301-189-K	X-4278	0.030%	1	3	3	O.K.	2	O.K.	D	-	D	-
301-189-L	X-4295	0.090%	0	2	1	O.K.	1	O.K.	D	-	U	-
301-189-M	X-4295	0.060%	0	2	1	O.K.	1	O.K.	D	-	U	-
301-189-N	X-4295	0.030%	0	2	1	O.K.	1	O.K.	D	-	U	-
301-206-A	X-4296	0.090%	0	5	-	-	-	-	-	-	-	-
301-206-B	X-4296	0.060%	0	5	-	-	-	-	-	-	-	-
301-206-C	X-4296	0.030%	0	5	-	-	-	-	-	-	-	-
301-206-D	X-4300	0.060%	1	3	2	O.K.	1	O.K.	S	YES	U	-
301-206-E	X-4300	0.090%	1	3	2	O.K.	1	O.K.	S	YES	U	-

Table 46 (continued)

Screening Epoxy Ester Resins

Code	Resin	Drier Content	Air Dried Film		30 min. @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
			Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-240-A	X-4334	0.060%	0	3	1	O.K.	1	O.K.	S	YES	U	-
301-240-B	X-4334	0.090%	0	3	1	O.K.	1	O.K.	S	YES	U	-
301-240-C	75% X-4334: 25% ST-847	0.060%	0	3	1	O.K.	1	O.K.	S	YES	U	-
301-240-D	75% X-4334: 25% ST-847	0.090%	0	3	1	O.K.	1	O.K.	S	YES	U	-
301-240-E	50% X-4334: 50% ST-847	0.060%	0	3	1	O.K.	1	O.K.	S	YES	S	NO
301-240-F	50% X-4334: 50% ST-847	0.090%	0	3	1	O.K.	1	O.K.	S	YES	U	-
301-240-G	25% X-4334: 75% ST-847	0.060%	0	3	1	O.K.	1	O.K.	S	YES	U	-
301-240-H	25% X-4334: 75% ST-847	0.090%	0	3	1	O.K.	1	O.K.	S	YES	U	-
301-242-F	X-3540	0.060%	2	5	-	-	-	-	-	-	-	-
301-242-G	X-3540	0.090%	2	5	-	-	-	-	-	-	-	-
301-243-A	75% X-4240: 25% R-55	0.060%	2	3	2	O.K.	1	O.K.	S	YES	U	-
301-243-B	75% X-4240: 25% R-55	0.090%	1	3	1	O.K.	1	O.K.	S	YES	U	-
301-243-C	50% X-4240: 50% R-55	0.060%	1	3	1	O.K.	1	O.K.	S	YES	U	-
301-243-D	50% X-4240: 50% R-55	0.090%	1	2	1	O.K.	1	O.K.	S	YES	U	-
301-243-E	75% X-4263: 25% R-55	0.060%	1	3	1	O.K.	1	O.K.	S	YES	U	-
301-243-F	75% X-4263: 25% R-55	0.090%	1	3	1	O.K.	1	O.K.	S	YES	U	-
301-243-G	50% X-4263: 50% R-55	0.060%	1	3	1	O.K.	1	O.K.	S	YES	U	-
301-243-H	50% X-4263: 50% R-55	0.090%	1	3	1	O.K.	0	O.K.	S	YES	U	-
301-244-A	75% X-4283: 25% R-55	0.060%	2	3	0	O.K.	0	O.K.	S	YES	U	-
301-244-B	75% X-4283: 25% R-55	0.090%	1	3	0	O.K.	0	O.K.	S	YES	U	-

Table 46 (continued)

Screening Epoxy Ester Resins

Code	Resin	Drier Content	Air Dried Film		30 min. @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
			Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-244-C	50% X-4283: 50% R-55	0.060%	1	2	0	O.K.	0	O.K.	S	YES	U	-
301-244-D	50% X-4283: 50% R-55	0.090%	1	1	0	O.K.	0	O.K.	S	YES	U	-
301-244-E	75% X-3540: 25% ST-847	0.060%	1	2	1	O.K.	1	O.K.	S	YES	U	-
301-244-F	X-3548	0.060%	2	2	1	O.K.	1	O.K.	D	-	U	-
301-244-G	X-3548	0.090%	2	2	1	O.K.	1	O.K.	D	-	U	-
301-245-D	X-3548	0.030%	1	2	1	O.K.	1	O.K.	S	YES	U	-
301-244-H	75% X-3548: 25% ST-847	0.060%	1	2	1	O.K.	1	O.K.	D	-	U	-
301-245-E	75% X-3548: 25% ST-847	0.030%	1	2	1	O.K.	1	O.K.	S	YES	U	-
301-335-A	EPOTUF 6401	0.060%	2	0	1	O.K.	1	O.K.	S	YES	U	-
301-335-B	EPOTUF 6401	0.120%	2	0	2	O.K.	1	O.K.	S	YES	U	-
301-335-C	EPITEX 120	0.060%	2	0	1	O.K.	0	O.K.	S	YES	U	-
301-335-D	EPITEX 120	0.120%	2	0	1	O.K.	0	O.K.	S	YES	U	-
301-335-E	EPITEX 1341	0.060%	2	0	0	O.K.	0	O.K.	S	YES	S	NO
301-335-F	EPITEX 1341	0.120%	3	1	1	O.K.	1	O.K.	S	YES	S	NO
301-335-G	EPITEX 1486	0.060%	2	0	1	O.K.	0	O.K.	S	NO	S	NO
301-335-H	EPITEX 1486	0.120%	2	0	0	O.K.	0	O.K.	S	NO	S	NO
301-335-J	Midland R-2	0.060%	2	0	0	O.K.	0	O.K.	D	-	S	NO
301-335-K	Midland R-2	0.120%	4	0	0	N.G.	0	N.G.	D	-	S	NO

Table 46 (continued)

Screening Epoxy Ester Resins

Code	Resin	Drier Content	Air Dried Film		30 min. @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
			Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-336-A	50% EPOTUF 6401:50% ST-847	0.060%	1	0	0	O.K.	0	O.K.	S	YES	S	NO
301-336-B	50% EPOTUF 6401:50% ST-847	0.120%	1	0	0	O.K.	0	O.K.	S	YES	S	NO
301-336-C	75% EPOTUF 6401:25% ST-847	0.060%	1	0	1	O.K.	1	O.K.	S	YES	U	-
301-336-D	75% EPOTUF 6401:25% ST-847	0.120%	1	0	1	O.K.	1	O.K.	S	YES	U	-
301-336-E	50% EPITEX 120: 50% ST-847	0.060%	0	0	0	O.K.	0	O.K.	S	YES	S	NO
301-336-F	50% EPITEX 120: 50% ST-847	0.120%	1	0	0	O.K.	0	O.K.	S	YES	S	NO
301-336-G	75% EPITEX 120: 25% ST-847	0.060%	0	0	0	O.K.	0	O.K.	S	YES	U	-
301-336-H	75% EPITEX 120: 25% ST-847	0.120%	1	0	0	O.K.	0	O.K.	S	YES	U	-
301-336-J	50% EPITEX 1341:50% ST-847	0.060%	1	0	0	O.K.	0	O.K.	S	YES	S	NO
301-337-A	50% EPITEX 1341:50% ST-847	0.120%	2	0	1	O.K.	0	O.K.	S	YES	S	NO
301-337-B	75% EPITEX 1341:25% ST-847	0.060%	3	0	1	O.K.	1	O.K.	S	YES	S	NO
301-337-C	75% EPITEX 1341:25% ST-847	0.120%	2	0	1	O.K.	1	O.K.	S	YES	S	NO
301-337-D	50% EPITEX 1486:50% ST-847	0.060%	1	0	0	O.K.	0	O.K.	S	YES	S	NO
301-337-E	50% EPITEX 1486:50% ST-847	0.120%	1	0	0	O.K.	0	O.K.	S	YES	S	NO
301-337-F	75% EPITEX 1486:25% ST-847	0.060%	2	0	1	O.K.	1	O.K.	S	YES	S	NO
301-337-G	75% EPITEX 1486:25% ST-847	0.120%	2	0	1	O.K.	1	O.K.	S	YES	S	NO
301-337-H	50% Midland R-2:50% ST-847	0.060%	1	0	0	O.K.	0	O.K.	S	NO	S	NO
301-337-J	50% Midland R-2:50% ST-847	0.120%	1	0	0	O.K.	0	O.K.	S	YES	S	NO
301-338-A	75% Midland R-2:25% ST-847	0.060%	2	0	0	O.K.	0	O.K.	D	-	S	NO
301-338-B	75% Midland R-2:25% ST-847	0.120%	2	0	0	O.K.	0	O.K.	D	-	S	NO

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

Table 47

Effect of Pigment Content in Midland R-55: Plaskon ST-847 Primer on Bimetallic Corrosion Resistance

Primer Code	Primer Vehicle	Pigment Content	Pigment	Rating
301-134-E	75% Midland R-55: 25% Plaskon ST-847	65%	Zinc Chromate	5
301-135-A	75% Midland R-55: 25% Plaskon ST-847	55%	Zinc Chromate	5
301-135-B	75% Midland R-55: 25% Plaskon ST-847	45%	Zinc Chromate	3
301-103-A (301-135-C)	75% Midland R-55: 25% Plaskon ST-847	35%	Zinc Chromate	2
301-135-D	75% Midland R-55: 25% Plaskon ST-847	25%	Zinc Chromate	3
301-135-E	75% Midland R-55: 25% Plaskon ST-847	15%	Zinc Chromate	3
301-90-F	75% Midland R-55: 25% Plaskon ST-847	0%	-	2

Bimetallic Corrosion Rating System

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 48

Effect of Pigment Content in Midland R-55: Plaskon ST-847 Primer on 5% Salt Spray Performance

Primer Code	Results	Hours Tested
301-134-E	Many very small blisters; slight corrosion and lifting on scribe.	1800
301-135-A	Very few very small blisters.	2000
301-135-B	Completely unaffected.	2000
301-103-A (301-135-C)	Completely unaffected.	2000
301-135-D	Few very small blisters on scribe.	2000
301-135-E	Completely unaffected.	2000
301-90-F	Severely blistered.	400

FIG. 8

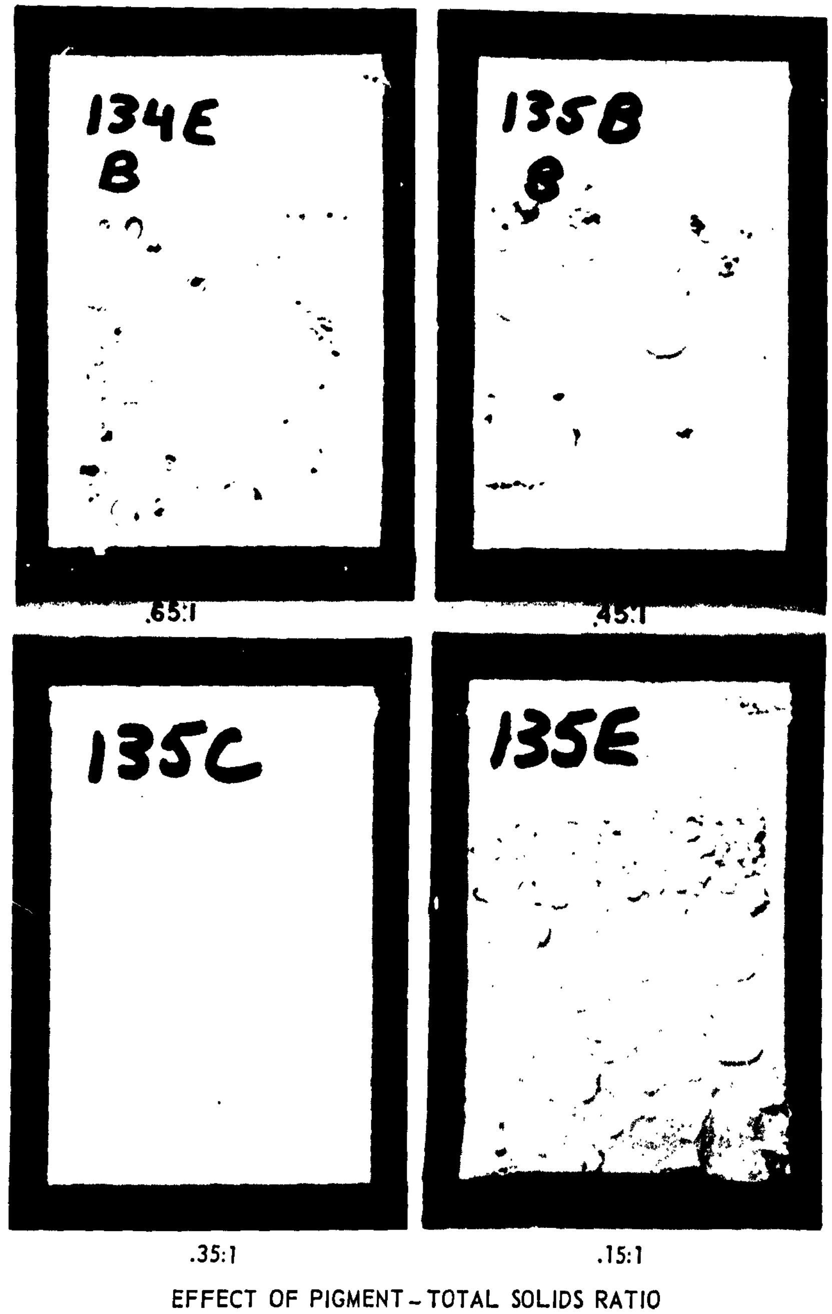


Fig. 8

EFFECT OF PIGMENT CONTENT ON GALVANIC CORROSION RESISTANCE OF A SILICONE-EPOXY: POLYAMIDE PRIMER

The following resin systems were believed worthy of testing based on results of screening tests on the clear resins:

1. Midland X-4240
2. 75% Midland R-55
   25% Midland X-4235
3. Midland R-55
4. Midland X-4245
5. Midland X-4263
6. Midland X-4271
7. Midland X-4282
8. Midland X-4283
9. Midland X-4300
10. 50% Midland X-4283
    50% Midland R-55
11. 50% Midland X-4240
    50% Midland R-55
12. 50% Midland X-4263
    50% Midland R-55
13. Midland X-3548
14. 75% Midland X-3548
    25% Plaskon ST-856
15. Midland X-4334
16. Midland X-3540
17. 75% Midland X-3540
    25% Plaskon ST-847
18. Reichhold Epotuf 6401
19. 75% Reichhold Epotuf 6401
    25% Plaskon ST-847
20. Jones-Dabney Epitex 120

21. 75% Jones-Dabney Epitex 120
    25% Plaskon ST-847

22. Jones-Dabney Epitex 1341

23. 50% Jones-Dabney Epitex 1341
    50% Plaskon ST-847

24. 75% Jones-Dabney Epitex 1486
    25% Plaskon ST-847

25. 50% Jones-Dabney Epitex 1486
    50% Plaskon ST-847

To expedite testing of these vehicles in primers, many of the primers were made using only zinc or calcium chromate as pigment. Earlier testing of primers had shown the strontium chromate to be an ineffective corrosion inhibitor. In some of the primers the calcium chromate also was not used since the zinc chromate appeared to be the best pigment in epoxy ester coatings.

As a result of the bimetallic corrosion and salt spray testing, the following primers were included in future testing:

1. 301-158-C
2. 301-158-L
3. 301-159-D
4. 301-159-G
5. 301-202-A

For results of galvanic corrosion and salt spray testing of epoxy ester primers, see Tables 49 and 50.

Table 49

Bimetallic Corrosion Testing of Epoxy Ester Primers

Primer Code	Primer Vehicle	Pigment	Rating
301-158-A	Midland X-4240	Zinc Chromate	2
301-158-B	Midland X-4240	Strontium Chromate	3
301-158-C	Midland X-4240	Calcium Chromate	2
301-158-D	75% Midland R-55: 25% Midland X-4235	Zinc Chromate	4
301-158-E	75% Midland R-55: 25% Midland X-4235	Strontium Chromate	5
301-158-F	75% Midland R-55: 25% Midland X-4235	Calcium Chromate	5
301-158-G	Midland R-55	Zinc Chromate	4
301-158-H	Midland R-55	Strontium Chromate	4
301-158-K	Midland R-55	Calcium Chromate	4
301-158-L	Midland X-4245	Zinc Chromate	2
301-158-M	Midland X-4245	Strontium Chromate	4
301-158-N	Midland X-4245	Calcium Chromate	4
301-159-A	Midland X-4263	Zinc Chromate	5
301-159-B	Midland X-4263	Strontium Chromate	5
301-159-C	Midland X-4263	Calcium Chromate	5
301-159-D	Midland X-4271	Zinc Chromate	2
301-159-G	Midland X-4282	Zinc Chromate	2
301-202-A	Midland X-4283	Zinc Chromate	2
301-202-E	Midland X-4300	Zinc Chromate	3
301-233-C	50% Midland X-4283: 50% Midland R-55	Zinc Chromate	3
301-233-D	50% Midland X-4240: 50% Midland R-55	Zinc Chromate	3
301-233-E	50% Midland X-4263: 50% Midland R-55	Zinc Chromate	3

Table 49 (continued)

Bimetallic Corrosion Testing of Epoxy Ester Primers

Primer Code	Primer Vehicle	Pigment	Rating
301-266-F	Midland X-3548	Zinc Chromate	3
301-266-G	75% Midland X-3548: 25% Plaskon ST-847	Zinc Chromate	3
301-274-A	Midland X-4334	Zinc Chromate	3
301-274-B	Midland X-3540	Zinc Chromate	3
301-274-C	75% Midland X-3540: 25% Plaskon ST-847	Zinc Chromate	3
301-340-B	Epotuf 6401	Zinc Chromate	3
301-340-E	Epotuf 6401	Calcium Chromate	3
301-340-C	75% Epotuf 6401: 25% Plaskon ST-847	Zinc Chromate	2
301-340-F	75% Epotuf 6401: 25% Plaskon ST-847	Calcium Chromate	3
301-340-H	Epitex 120	Zinc Chromate	3
301-341-B	Epitex 120	Calcium Chromate	3
301-340-J	75% Epitex 120: 25% Plaskon ST-847	Zinc Chromate	3
301-341-C	75% Epitex 120: 25% Plaskon ST-847	Calcium Chromate	3
301-341-E	Epitex 1341	Zinc Chromate	3
301-341-H	Epitex 1341	Calcium Chromate	3
301-341-F	50% Epitex 1341: 50% Plaskon ST-847	Zinc Chromate	3
301-341-J	50% Epitex 1341: 50% Plaskon ST-847	Calcium Chromate	3
301-342-B	75% Epitex 1486: 25% Plaskon ST-847	Zinc Chromate	3
301-342-E	75% Epitex 1486: 25% Plaskon ST-847	Calcium Chromate	3
301-342-C	50% Epitex 1486: 50% Plaskon ST-847	Zinc Chromate	3
301-342-F	50% Epitex 1486: 50% Plaskon ST-847	Calcium Chromate	3

Bimetallic Corrosion Rating System

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 50

5% Salt Spray Testing of Epoxy Ester Primers

Primer Code	Results	Hours Tested
301-158-A	Very slight corrosion and slight lifting on scribe.	2000
301-158-B	Many very small blisters and some corrosion.	1000
301-158-C	Few very small blisters and very slight corrosion on scribe.	2000
301-158-D	Few very small blisters and very slight corrosion on scribe.	2000
301-158-E	Many very small blisters and slight corrosion.	800
301-158-F	Very slight corrosion on scribe.	2000
301-158-G	Very few very small blisters; very few very small blisters and very slight corrosion on scribe.	2000
301-158-H	Many very small blisters.	600
301-158-K	Few very small blisters and slight corrosion.	2000
301-158-L	Very slight corrosion and very few small blisters on scribe.	2000
301-158-M	Many very small blisters and slight corrosion; slight lifting on scribe.	1200
301-158-N	Slight corrosion on scribe.	2000
301-159-A	Very slight corrosion on scribe.	2000
301-159-B	Slight corrosion.	1000
301-159-C	Slight corrosion on scribe.	2000
301-159-D	Few small blisters and very slight corrosion on scribe.	2000
301-159-G	Very few very small blisters and very slight corrosion on scribe.	2000
301-202-A	Few very small blisters and slight corrosion on scribe.	2000
301-202-E	Very slight corrosion and slight lifting on scribe.	2000
301-233-C	Slight corrosion on scribe.	2000
301-233-D	Very slight corrosion; many small and two medium blisters on scribe.	2000

Table 50 (continued)

5% Salt Spray Testing of Epoxy Ester Primers

Primer Code	Results	Hours Tested
301-233-E	Very slight corrosion; some small blisters on scribe.	2000
301-266-F	Many small and few medium blisters; slight corrosion and many small blisters on scribe.	800
301-266-G	Many very small and few small blisters, slight corrosion.	2000
301-274-A	Many very small blisters; few small blisters and slight corrosion on scribe.	2000
301-274-B	One medium blister and slight corrosion; few small blisters on scribe.	1600
301-274-C	Many small blisters and slight corrosion on scribe.	2000
301-340-B	Many very small blisters; few small blisters and slight corrosion on scribe.	2000
301-340-E	Many small and very small blisters, slight corrosion.	2000
301-340-C	Many very small blisters; slight corrosion on scribe.	2000
301-340-F	Many very small and few small blisters; slight corrosion on scribe.	2000
301-340-H	Many very small and few small blisters; slight corrosion on scribe.	2000
301-341-B	Not Tested.	-
301-340-J	Many very small blisters; few very small blisters and slight corrosion on scribe.	2000
301-341-C	Many very small and few small blisters; slight corrosion on scribe.	2000
301-341-E	Many very small and few small blisters; slight corrosion on scribe.	2000
301-341-H	Many very small and few small blisters, slight corrosion.	2000
301-341-F	Many very small blisters; slight corrosion on scribe.	2000
301-341-J	Some very small blisters; slight corrosion on scribe.	2000

Table 50 (continued)

5% Salt Spray Testing of Epoxy Ester Primers

Primer Code	Results	Hours Tested
301-342-B	Many very small and few small blisters, slight corrosion.	2000
301-342-E	Many very small blisters; slight corrosion on scribe.	2000
301-342-C	Many very small blisters; slight corrosion on scribe.	2000
301-342-F	Many very small and few small blisters; slight corrosion on scribe.	2000

E. Epoxy Ester Olive Drab Topcoats

Some of the epoxy ester vehicles which were used in the primers were also used in olive drab topcoats. Most of these coatings did not perform any better than the original coating systems but the following were selected for further testing:

	Primer	Topcoat
1.	301-103-A	301-174-B
2.	301-131-B	301-174-B
3.	301-131-B	301-174-C
4.	301-103-A	301-175-A
5.	301-103-A	301-175-B
6.	301-131-B	301-175-B

The results of bimetallic corrosion and salt spray testing of epoxy ester olive drab topcoats can be found in Tables 51 and 52.

Table 51

Bimetallic Corrosion Testing of Epoxy Ester Olive Drab Topcoats

Primer Code	Topcoat Code	Topcoat Vehicle	Rating
301-103-A	301-174-A	Midland X-4240	2
301-131-B	301-174-A	Midland X-4240	3
301-103-A	301-174-B	Midland X-4235	2
301-131-B	301-174-B	Midland X-4235	1
301-103-A	301-174-C	Midland X-4245	3
301-131-B	301-174-C	Midland X-4245	1
301-103-A	301-175-A	Midland X-4263	1
301-131-B	301-175-A	Midland X-4263	3
301-103-A	301-175-B	Midland R-55	1
301-131-B	301-175-B	Midland R-55	1
301-103-A	301-175-C	Midland X-4271	2
301-131-B	301-175-C	Midland X-4271	2
301-103-A	301-204-A	Midland X-4282	2
301-131-B	301-204-A	Midland X-4282	3
301-103-A	301-204-B	Midland X-4283	1
301-131-B	301-204-B	Midland X-4283	2
301-103-A	301-222-A	Midland X-4300	2
301-131-B	301-222-A	Midland X-4300	2
301-103-A	301-234-E	Midland X-3540	2
301-131-B	301-234-E	Midland X-3540	2

Table 51 (continued)

Bimetallic Corrosion Testing of Epoxy Ester Olive Drab Topcoats

Primer Code	Topcoat Code	Topcoat Vehicle	Rating
301-103-A	301-235-B	Midland X-4334	2
301-131-B	301-235-B	Midland X-4334	2
301-103-A	301-235-C	75% Midland X-4334: 25% Plaskon ST-847	2
301-131-B	301-235-C	75% Midland X-4334: 25% Plaskon ST-847	2
301-103-A	301-278-A	Midland X-3548	2
301-131-B	301-278-A	Midland X-3548	2

Bimetallic Corrosion Rating System

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 52

5% Salt Spray Testing of Epoxy Ester Olive Drab Topcoats

Primer Code	Topcoat Code	Adhesion	Results	Hours Tested
301-103-A	301-174-A	5	Slight corrosion on scribe.	2000
301-131-B	301-174-A	0	Many small blisters and very slight corrosion.	800
301-103-A	301-174-B	5	Few medium blisters; slight discoloration, lifting, and corrosion, all on scribe.	2000
301-131-B	301-174-B	1	Few very small blisters, slight lifting, and slight corrosion, all on scribe.	2000
301-103-A	301-174-C	5	Few very small blisters, slight lifting, and slight corrosion, all on scribe.	2000
301-131-B	301-174-C	1	Two small blisters, slight corrosion, and slight lifting, all on scribe.	2000
301-103-A	301-175-A	5	Slight corrosion on scribe.	2000
301-131-B	301-175-A	1	Few very small blisters and slight corrosion on scribe.	2000
301-103-A	301-175-B	1	Few very small blisters, slight corrosion, and very slight lifting, all on scribe.	2000
301-131-B	301-175-B	0	Few very small blisters; slight corrosion, lifting, and discoloration on scribe.	2000
301-103-A	301-175-C	5	Slight lifting and corrosion on scribe.	2000
301-131-B	301-175-C	5	Two small blisters, very slight lifting, very slight corrosion, all on scribe.	2000
301-103-A	301-204-A	5	One medium blister, very slight corrosion, and very slight lifting, all on scribe.	2000
301-131-B	301-204-A	0	Very slight corrosion and slight lifting on scribe.	2000
301-103-A	301-204-B	5	Some very small blisters; very slight lifting and corrosion on scribe.	2000
301-131-B	301-204-B	0	Few very small blisters and very slight corrosion on scribe.	2000
301-103-A	301-222-A	5	Very few small blisters and slight corrosion on scribe.	2000
301-131-B	301-222-A	5	Few small and one medium blister, slight corrosion, slight lifting, all on scribe.	2000
301-103-A	301-234-E	2	Some small blisters, moderate corrosion, slight lifting, all on scribe.	2000
301-131-B	301-234-E	5	Few small blisters and very slight corrosion on scribe.	2000

Table 52 (continued)

5% Salt Spray Testing of Epoxy Ester Olive Drab Topcoats

Primer Code	Topcoat Code	Adhesion	Results	Hours Tested
301-103-A	301-235-B	3	Some small, two large blisters, slight corrosion, slight lifting, all on scribe.	2000
301-131-B	301-235-B	0	Some very small blisters; many small and some medium blisters, slight corrosion and slight lifting on scribe.	2000
301-103-A	301-235-C	5	Some very small blisters; some small and few medium blisters, slight corrosion and lifting on scribe.	2000
301-131-B	301-235-C	0	Some very small blisters; many small blisters and slight corrosion on scribe.	2000
301-103-A	301-278-A	2	Few very small blisters; few medium and one large blister, slight corrosion and lifting on scribe.	1600
301-131-B	301-278-A	5	Many very small blisters; few medium blisters, slight corrosion and lifting on scribe.	1600

Adhesion Rating System

Rating	Description	Rating	Description
0	Excellent Adhesion	0	Excellent Adhesion
1	Less than 10% failure, topcoat from primer	1P	Less than 10% failure, primer from substrate
2	10-25% failure, topcoat from primer	2P	10-25% failure, primer from substrate
3	25-50% failure, topcoat from primer	3P	25-50% failure, primer from substrate
4	50-75% failure, topcoat from primer	4P	50-75% failure, primer from substrate
5	Complete lifting of topcoat from primer	5P	Complete lifting of primer from substrate

F. Epoxy Ester White Topcoats

The same vehicles used in the olive drab topcoats were used for the white coatings. The original pigmentation was used for these coatings. None of these materials performed well enough to merit future work. Galvanic corrosion and salt spray test results can be found in Tables 53 and 54.

Table 53

Bimetallic Corrosion Testing of Epoxy Ester White Topcoats

Primer Code	Topcoat Code	Topcoat Vehicle	Rating
301-103-A	301-210-C	Midland X-4240	2
301-131-B	301-210-C	Midland X-4240	2
301-103-A	301-210-D	75% Midland R-55: 25% Midland X-4235	2
301-131-B	301-210-D	75% Midland R-55: 25% Midland X-4235	2
301-103-A	301-210-E	Midland X-4245	2
301-131-B	301-210-E	Midland X-4245	2
301-103-A	301-210-F	Midland X-4263	2
301-131-B	301-210-F	Midland X-4263	2
301-103-A	301-210-G	Midland X-4271	2
301-131-B	301-210-G	Midland X-4271	2
301-103-A	301-210-H	Midland R-55	2
301-131-B	301-210-H	Midland R-55	2
301-103-A	301-211-E	Midland X-4282	2
301-131-B	301-211-E	Midland X-4282	2
301-103-A	301-211-F	Midland X-4283	2
301-131-B	301-211-F	Midland X-4283	2

Bimetallic Corrosion Rating System

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 54

5% Salt Spray Testing of Epoxy Ester White Topcoats

Primer Code	Topcoat Code	Adhesion	Results	Hours Tested
301-103-A	301-210-C	5	Many very small blisters; few small blisters, slight lifting and corrosion on scribe.	2000
301-131-B	301-210-C	4	Some very small blisters; slight lifting and very slight corrosion on scribe.	2000
301-103-A	301-210-D	5	Yellowing, many very small blisters; few small blisters and very slight corrosion on scribe.	2000
301-131-B	301-210-D	5	Many very small blisters; slight corrosion on scribe.	400
301-103-A	301-210-E	5	Some very small blisters; few small blisters and slight corrosion on scribe.	2000
301-131-B	301-210-E	2	Many very small blisters and very slight corrosion on scribe.	2000
301-103-A	301-210-F	5	One small blister and very slight corrosion on scribe.	2000
301-131-B	301-210-F	0	Many very small blisters; very slight corrosion on scribe.	2000
301-103-A	301-210-G	5	Many very small blisters; very slight corrosion on scribe.	2000
301-131-B	301-210-G	0	Many very small blisters; very slight corrosion on scribe.	2000
301-103-A	301-210-H	0	Many very small blisters; many small blisters and slight corrosion on scribe.	2000
301-131-B	301-210-H	0	Many very small and few small blisters, slight corrosion on scribe.	2000
301-103-A	301-211-E	5	Many very small blisters; some small blisters and very slight corrosion on scribe	2000
301-131-B	301-211-E	0	Many very small blisters; many small blisters and very slight corrosion on scribe	2000
301-103-A	301-211-F	5	Many very small blisters; some lifting and very slight corrosion on scribe.	2000
301-131-B	301-211-F	0	Many very small blisters; very slight corrosion on scribe.	2000

Adhesion Rating System

Rating	Description	Rating	Description
0	Excellent Adhesion	0	Excellent Adhesion
1	Less than 10% failure, topcoat from primer	1P	Less than 10% failure, primer from substrate
2	10-25% failure, topcoat from primer	2P	10-25% failure, primer from substrate
3	25-50% failure, topcoat from primer	3P	25-50% failure, primer from substrate
4	50-75% failure, topcoat from primer	4P	50-75% failure, primer from substrate
5	Complete lifting of topcoat from primer	5P	Complete lifting of primer from substrate

Section VIII

Epoxy and Silicone-Epoxy Copolymer Coatings

A. Preparation and Testing of New Vehicles

Since epoxies and silicone-epoxy copolymers had performed fairly well in the intial testing, it was decided to prepare some copolymers with different silicone contents for evaluation. The following materials were synthesized:

Code	Silicone	Epoxy
X-4311	25% Dow Corning R-861	75% Epon 1001
X-4313	(12.5% Dow Corning Z-6018 (12.5% Dow Corning QZ-8-0031	75% Epon 1001
X-4315	25% Dow Corning Z-6018	75% Epon 1001
X-4316	15% Dow Corning Z-6018	85% Epon 1001
X-4317	35% Dow Corning Z-6018	65% Epon 1001
X-4209	50% Dow Corning Z-6018	50% Epon 1001

B. Screening of Clear Resins

The silicone-epoxy copolymers were screened in the usual manner. Versamid 115, Dow Corning Z-6020, and diethylene triamine were used as catalysts. Almost all of these materials were excellent when tested in the clear film as can be seen from Table 55.

C. Epoxy and Silicone-Epoxy Primers

Primers were prepared from a number of epoxy and silicone-epoxy resins. Only two of them, 301-188-C and 301-232-E, were included in future work. Results of bimetallic corrosion and salt spray testing of the epoxy and silicone-epoxy primers can be found in Tables 56 and 57.

Table 55

Screening Silicone-Epoxy Copolymer Systems

Vehicle Code	Silicone Epoxy Copolymer	Curing Agent	%	Air Dried Film		30 min. @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
				Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-228-J	X-4311	Versamid 115	10	1	0	0	O.K.	0	O.K.	S	YES	U	-
301-228-K			25	0	1	0	O.K.	0	O.K.	U	-	U	-
301-228-L			50	1	1	1	O.K.	1	O.K.	S	YES	U	-
301-229-A	X-4311	Dow Corning Z-6020	2	0	1	0	O.K.	0	O.K.	S	YES	U	-
301-229-B			5	0	1	0	O.K.	0	O.K.	S	YES	U	-
301-229-C			10	0	1	0	O.K.	0	O.K.	U	-	U	-
301-229-D	X-4311	DET	2	0	1	0	O.K.	0	O.K.	U	-	U	-
301-229-E			5	1	1	0	O.K.	0	O.K.	U	-	U	-
301-228-A	X-4313	Versamid 115	10	1	2	0	O.K.	0	O.K.	S	NO	S	NO
301-228-B			25	1	2	0	O.K.	0	O.K.	S	YES	U	-
301-228-C			50	0	2	1	O.K.	1	O.K.	S	YES	U	-
301-228-D	X-4313	Dow Corning Z-6020	2	1	1	0	O.K.	0	O.K.	S	YES	S	NO
301-228-E			5	0	2	0	O.K.	0	O.K.	S	YES	U	-
301-228-F			10	0	1	0	O.K.	0	O.K.	U	-	U	-
301-228-G	X-4313	DET	2	1	3	0	N.G.	0	N.G.	S	YES	S	YES
301-228-H			5	2	1	0	O.K.	0	O.K.	U	-	U	-
301-229-F	X-4315	Versamid 115	10	0	1	0	O.K.	1	O.K.	S	YES	U	-
301-229-G			25	0	0	0	O.K.	1	O.K.	S	YES	U	-
301-229-H			50	0	1	1	O.K.	1	O.K.	S	YES	U	-

Table 55 (continued)

Screening Silicone-Epoxy Copolymer Systems

Vehicle Code	Silicone Epoxy Copolymer	Curing Agent	%	Air Dried Film		30 min. @500F.		2 hr. @500F.		MIL-S-3136 Fluid		Lubricant	
				Dry	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-229-J	X-4315	Dow Corning Z-6020	2	0	1	1	O.K.	1	O.K.	S	YES	S	NO
			5	0	2	1	O.K.	1	O.K.	S	YES	U	-
			10	0	1	0	O.K.	1	O.K.	U	-	U	-
301-229-M	X-4315	DET	2	1	1	1	O.K.	1	O.K.	U	-	U	-
301-229-N			5	1	1	1	O.K.	1	O.K.	U	-	U	-
301-231-A	X-4316	Versamid 115	10	0	1	1	O.K.	1	O.K.	S	YES	S	NO
301-231-B			25	0	1	1	O.K.	1	O.K.	S	YES	U	-
301-231-C			50	0	0	0	O.K.	1	O.K.	S	YES	U	-
301-231-D	X-4317	Versamid 115	10	0	1	1	O.K.	1	O.K.	S	YES	S	NO
301-231-E			25	0	1	1	O.K.	1	O.K.	S	YES	U	-
301-231-F			50	0	1	1	O.K.	1	O.K.	S	YES	U	-

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

Table 56 (continued)

Bimetallic Corrosion Testing of Epoxy and Silicone-Epoxy Primers

Primer Code	Primer Vehicle	Pigment	Rating
301-405-B	Eponol H-55.1 - B40 75% Pigment	Zinc Chromate	5
301-405-A	Eponol H-55.1 - B40 75% Pigment	Calcium Chromate	5
301-405-D	Eponol H-55.1 - B40 65% Pigment	Zinc Chromate	5
301-405-E	Eponol H-55.1 - B40 65% Pigment	Calcium Chromate	5
301-405-F	Eponol H-55.1 - B40 50% Pigment	Zinc Chromate	5
301-405-G	Eponol H-55.1 - B40 50% Pigment	Calcium Chromate	5
301-275-A	Eponol H-55.1 - B40 35% Pigment	Zinc Chromate	5
301-275-B	Eponol H-55.1 - B40 35% Pigment	Calcium Chromate	5
301-405-C	Eponol H-55.1 - B40 75% Pigment	Iron Oxide	5
301-406-A	Eponol H-55.1 - B40 65% Pigment	Iron Oxide	5
301-406-B	Eponol H-55.1 - B40 50% Pigment	Iron Oxide	5
301-406-C	95% Eponol H-55.1 - B40: 5% Mondur CB-75 75% Pigment	Zinc Chromate	5
301-406-E	95% Eponol H-55.1 - B40: 5% Mondur CB-75 75% Pigment	Calcium Chromate	5
301-406-D	85% Eponol H-55.1 - B40: 15% Mondur CB-75 75% Pigment	Zinc Chromate	5
301-406-F	85% Eponol H-55.1 - B40: 15% Mondur CB-75 75% Pigment	Calcium Chromate	5

Bimetallic Corrosion Rating System

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 57

5% Salt Spray Testing of Epoxy and Silicone-Epoxy Primers

Primer Code	Results	Hours Tested
301-203-G	Very few small blisters; slight corrosion and many small blisters on scribe.	2000
301-203-F	Few small blisters; slight lifting and many very small blisters on scribe.	2000
301-232-D	Few very small blisters; many very small and one large blister on scribe.	2000
301-232-E	Very few small blisters and slight corrosion; many very small blisters and slight corrosion on scribe.	2000
301-232-F	Many very small and few small blisters; few small and many very small blisters, slight corrosion on scribe.	2000
301-188-A	One large blister and corrosion, severe fading; moderate corrosion and many blisters on scribe.	400
301-188-B	Many small blisters, severe fading	200
301-188-C	Very few small blisters and slight lifting; many small blisters on scribe.	2000
301-188-D	Some corrosion, severe fading.	200
301-188-E	Some corrosion, flaking, and severe fading.	200
301-188-F	Few small blisters, severe fading.	400
301-188-G	Some corrosion, severe fading; some corrosion on scribe.	200
301-202-D	Many very small blisters and severe fading; moderate corrosion on scribe.	200
301-267-C	Many small blisters and some corrosion; moderate corrosion and lifting on scribe.	800
301-267-D	Many small blisters, moderate corrosion and fading.	200
301-266-C	Many small and medium blisters; slight corrosion and lifting on scribe.	800
301-266-D	Many small blisters; slight corrosion and lifting on scribe.	200
301-266-E	Many small and medium blisters; slight corrosion and lifting on scribe.	800

Table 37 (continued)

5% Salt Spray Testing of Epoxy and Silicone-Epoxy Primers

Primer Code	Results	Hours Tested
301-405-B	Many small and very small blisters, slight corrosion, severe fading.	1000
301-405-A	Many small and very small blisters, severe fading.	1000
301-405-D	Some small and very small blisters, severe fading; slight corrosion on scribe.	1000
301-405-E	Few small blisters, severe fading, slight corrosion.	2000
301-405-F	Few small and very small blisters, severe fading, some corrosion.	2000
301-405-G	Few very small and some small blisters, severe fading, slight corrosion.	2000
301-275-A	Many small and few medium blisters, slight corrosion.	200
301-275-B	Many small and very small blisters, slight corrosion.	2000
301-405-C	Some small and very small blisters, one large blister, severe corrosion.	600
301-406-A	Few very small and some small blisters, slight corrosion.	2000
301-406-B	Few very small and some small blisters; slight corrosion on scribe.	2000
301-406-C	Not tested.	-
301-406-E	Not tested.	-
301-406-D	Not tested.	-
301-406-F	Not tested.	-

D. Epoxy and Silicone-Epoxy Olive Drab Topcoats

None of the olive drab topcoats made from the epoxy and silicone-epoxy resins performed as well as expected and all were eliminated from future testing. Bimetallic corrosion and salt spray results can be found in Tables 58 and 59.

E. Epoxy and Silicone-Epoxy White Topcoats

Of the white systems tested, only the following was considered satisfactory:

Primer	Topcoat
301-131-B	301-211-C

Results of galvanic corrosion and salt spray testing can be found in Tables 60 and 61.

Table 58

Bimetallic Corrosion Testing of Epoxy and Silicone-Epoxy Olive Drab Topcoats

Primer Code	Topcoat Code	Topcoat Vehicle	Rating
301-103-A	301-222-D	75% Midland X-4311: 25% Versamid 115	2
301-131-B	301-222-D	75% Midland X-4311: 25% Versamid 115	2
301-103-A	301-223-B	75% Midland X-4313: 25% Versamid 115	3
301-131-B	301-223-B	75% Midland X-4313: 25% Versamid 115	2
301-103-A	301-223-D	75% Midland X-4315: 25% Versamid 115	5
301-131-B	301-223-D	75% Midland X-4315: 25% Versamid 115	2
301-103-A	301-234-B	75% Midland X-4316: 25% Versamid 115	2
301-131-B	301-234-B	75% Midland X-4316: 25% Versamid 115	2
301-103-A	301-234-D	75% Midland X-4317: 25% Versamid 115	2
301-131-B	301-234-D	75% Midland X-4317: 25% Versamid 115	2
301-103-A	301-204-C	90% Epon 1001: 10% Shell H-1	3
301-131-B	301-204-C	90% Epon 1001: 10% Shell H-1	2
301-103-A	301-204-E	90% Midland X-4209: 10% Shell H-1	3
301-131-B	301-204-E	90% Midland X-4209: 10% Shell H-1	5
301-103-A	301-204-F	90% Dow Corning XR-6-0000: 10% Shell H-1	2
301-131-B	301-204-F	90% Dow Corning XR-6-0000: 10% Shell H-1	4
301-103-A	301-279-A	Shell Eponol H-55.1 - B40	N.T.
301-131-B	301-279-A	Shell Eponol H-55.1 - B40	3

Bimetallic Corrosion Rating System

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 59

5% Salt Spray Testing of Epoxy and Silicone-Epoxy Olive Drab Topcoats

Primer Code	Topcoat Code	Adhesion	Results	Hours Tested
301-103-A	301-222-D	3P	Many very small and one large blister, slight corrosion; slight lifting on scribe.	2000
301-131-B	301-222-D	0	Many very small and one large blister; few small blisters, slight corrosion and lifting on scribe.	2000
301-103-A	301-223-B	3P	Many very small blisters; one large blister, slight corrosion and lifting on scribe.	2000
301-131-B	301-223-B	0	Many very small blisters; one medium blister, slight corrosion and lifting on scribe.	2000
301-103-A	301-223-D	1	Some very small blisters; few medium blisters, moderate corrosion and slight lifting on scribe.	2000
301-131-B	301-223-D	0	Two large and few medium blisters, moderate corrosion, slight lifting and discoloration, all on scribe.	2000
301-103-A	301-234-B	3P	Very few small blisters; two large and some medium blisters, moderate corrosion and lifting on scribe.	2000
301-131-B	301-234-B	0	Some very small blisters; two medium blisters, moderate corrosion and slight lifting on scribe.	2000
301-103-A	301-234-D	3P	Many very small blisters; some small and two medium blisters, moderate corrosion and slight lifting on scribe.	2000
301-131-B	301-234-D	0	One small blister; one medium blister, slight corrosion and lifting on scribe.	2000
301-103-A	301-204-C	0	Few small blisters; moderate corrosion, slight lifting and discoloration on scribe.	2000
301-131-B	301-204-C	0	Very many small blisters.	200
301-103-A	301-204-E	0	Severe cracking	200
301-131-B	301-204-E	-	Not Tested.	-

Table 59 (continued)

5% Salt Spray Testing of Epoxy and Silicone-Epoxy Olive Drab Topcoats

Primer Code	Topcoat Code	Adhesion	Results	Hours Tested
301-103-A	301-204-F	0	Few small blisters; slight discoloration, lifting, and corrosion on scribe.	1400
301-131-B	301-204-F	0	Many small blisters; slight discoloration and corrosion on scribe.	400
301-103-A	301-279-A	-	Not Tested.	-
301-131-B	301-279-A	0	Few very small and one small blister; few small blisters and slight corrosion on scribe.	2000

Adhesion Rating System

Rating	Description	Rating	Description
0	Excellent Adhesion	0	Excellent Adhesion
1	Less than 10% failure, topcoat from primer	1P	Less than 10% failure, primer from substrate
2	10-25% failure, topcoat from primer	2P	10-25% failure, primer from substrate
3	25-50% failure, topcoat from primer	3P	25-50% failure, primer from substrate
4	50-75% failure, topcoat from primer	4P	50-75% failure, primer from substrate
5	Complete lifting of topcoat from primer	5P	Complete lifting of primer from substrate

Table 60

Bimetallic Corrosion Testing of Epoxy and Silicone-Epoxy White Topcoats

Primer Code	Topcoat Code	Topcoat Vehicle	Rating
301-103-A	301-211-K	75% Midland X-4311: 25% Versamid 115	2
301-131-B	301-211-K	75% Midland X-4311: 25% Versamid 115	3
301-103-A	301-246-B	75% Midland X-4313: 25% Versamid 115	3
301-131-B	301-246-B	75% Midland X-4313: 25% Versamid 115	2
301-103-A	301-246-D	75% Midland X-4315: 25% Versamid 115	2
301-131-B	301-246-D	75% Midland X-4315: 25% Versamid 115	2
301-103-A	301-246-F	75% Midland X-4316: 25% Versamid 115	2
301-131-B	301-246-F	75% Midland X-4316: 25% Versamid 115	2
301-103-A	301-246-H	75% Midland X-4317: 25% Versamid 115	2
301-131-B	301-246-H	75% Midland X-4317: 25% Versamid 115	2
301-103-A	301-211-A	90% Epon 1001: 10% Shell H-1	2
301-131-B	301-211-A	90% Epon 1001: 10% Shell H-1	2
301-103-A	301-211-B	90% Epon 1009: 10% Shell H-1	3
301-131-B	301-211-B	90% Epon 1009: 10% Shell H-1	3
301-103-A	301-211-C	90% Midland X-4209: 10% Shell H-1	N.T.
301-131-B	301-211-C	90% Midland X-4209: 10% Shell H-1	1
301-103-A	301-211-D	90% Dow Corning XR-6-0000: 10% Shell H-1	2
301-131-B	301-211-D	90% Dow Corning XR-6-0000: 10% Shell H-1	2
301-103-A	301-279-B	Shell Eponol H-55.1 - B40	4
301-131-B	301-279-B	Shell Eponol H-55.1 - B40	4

Bimetallic Corrosion Rating System

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 61

5% Salt Spray Testing of Epoxy and Silicone-Epoxy White Topcoats

Primer Code	Topcoat Code	Adhesion	Results	Hours Tested
301-103-A	301-211-K	3P	Many very small blisters; some small blisters, very slight lifting and corrosion on scribe.	2000
301-131-B	301-211-K	0	Many very small blisters; slight corrosion on scribe.	2000
301-103-A	301-246-B	0	Many very small blisters; very slight corrosion on scribe.	2000
301-131-B	301-246-B	0	Many very small blisters; slight corrosion on scribe.	2000
301-103-A	301-246-D	0	Many very small blisters; some small and medium blisters, very slight corrosion on scribe.	2000
301-131-B	301-246-D	0	Many very small blisters; very slight corrosion on scribe.	2000
301-103-A	301-246-F	0	Many very small blisters; very slight corrosion on scribe.	2000
301-131-B	301-246-F	0	Many very small blisters; slight corrosion on scribe.	2000
301-103-A	301-246-H	3	Many very small blisters; few small blisters, slight lifting and corrosion on scribe.	2000
301-131-B	301-246-H	0	Some very small blisters; some small and one medium blister, slight corrosion on scribe.	2000
301-103-A	301-211-A	0	Many very small blisters; few small blisters and very slight corrosion on scribe.	2000
301-131-B	301-211-A	0	Many very small blisters; slight corrosion on scribe.	2000
301-103-A	301-211-B	0	Many very small blisters; few small blisters, slight lifting and very slight corrosion on scribe.	2000
301-131-B	301-211-B	0	Many small blisters.	
301-103-A	301-211-C	-	Not Tested.	-
301-131-B	301-211-C	1	Some very small blisters; few small blisters, very slight corrosion, slight lifting on scribe.	2000

Table 61 (continued)

5% Salt Spray Testing of Epoxy and Silicone-Epoxy White Topcoats

Primer Code	Topcoat Code	Adhesion	Results	Hours Tested
301-103-A	301-211-D	0	Many very small blisters, cracking.	1000
301-131-B	301-211-D	0	Few very small blisters; very slight corrosion on scribe.	2000
301-103-A	301-279-B	0	Not Tested.	-
301-131-B	301-279-B	0	Many very small blisters; few small blisters, very slight corrosion on scribe.	2000

Adhesion Rating System

Rating	Description	Rating	Description
0	Excellent Adhesion	0	Excellent Adhesion
1	Less than 10% failure, topcoat from primer	1P	Less than 10% failure, primer from substrate
2	10-25% failure, topcoat from primer	2P	10-25% failure, primer from substrate
3	25-50% failure, topcoat from primer	3P	25-50% failure, primer from substrate
4	50-75% failure, topcoat from primer	4P	50-75% failure, primer from substrate
5	Complete lifting of topcoat from primer	5P	Complete lifting of primer from substrate

Section IX

Miscellaneous Primer Work

A. Conventional Primers

It was decided to evaluate some conventional corrosion inhibiting primers under some of the better topcoats. The following materials were chosen for evaluation:

	Primer Code	Type
1.	407	MIL-P-15328
2.	621	TT-E-485d Olive Drab
3.	408	MIL-P-7962
4.	503	MIL-P-11414A

The wash primer, 407, was catalyzed with half the normal acid.

The following olive drab topcoats were used over the conventional primers:

1. 301-114-C
2. 301-115-A
3. 301-134-A
4. 301-134-C
5. 301-118-F

In general, the performance of coating systems using conventional primers was poor. In the few cases where performance in the bimetallic coupling test was fairly good, the salt spray results were not as good as those obtained when the experimental primers were used. The conventional primers were, therefore, eliminated from additional testing. Bimetallic corrosion and salt spray results are in Tables 62 and 63. (See fig. 9)

Table 62

Bimetallic Corrosion Testing of Olive Drab Coating Systems Using Conventional Primers

Primer Code	Topcoat Code	Topcoat Vehicle	Rating
407	301-114-C	Dow Corning R-6-0031: Bakelite BRS-2600	5
621	301-114-C	Dow Corning R-6-0031: Bakelite BRS-2600	5
408	301-114-C	Dow Corning R-6-0031: Bakelite BRS-2600	4
503	301-114-C	Dow Corning R-6-0031: Bakelite BRS-2600	3
407	301-115-A	Midland R-55: Plaskon ST-847	2
621	301-115-A	Midland R-55: Plaskon ST-847	3
408	301-115-A	Midland R-55: Plaskon ST-847	1
503	301-115-A	Midland R-55: Plaskon ST-847	5
407	301-134-A	Midland X-4209: Versamid 115	5
621	301-134-A	Midland X-4209: Versamid 115	2
408	301-134-A	Midland X-4209: Versamid 115	3
503	301-134-A	Midland X-4209: Versamid 115	3
407	301-134-C	Dow Corning XR-6-0000: Versamid 115	5
621	301-134-C	Dow Corning XR-6-0000: Versamid 115	2
408	301-134-C	Dow Corning XR-6-0000: Versamid 115	2
503	301-134-C	Dow Corning XR-6-0000: Versamid 115	2
407	301-118-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	5
621	301-118-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	5
408	301-118-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	2
503	301-118-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	2

Bimetallic Corrosion Rating System

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 63

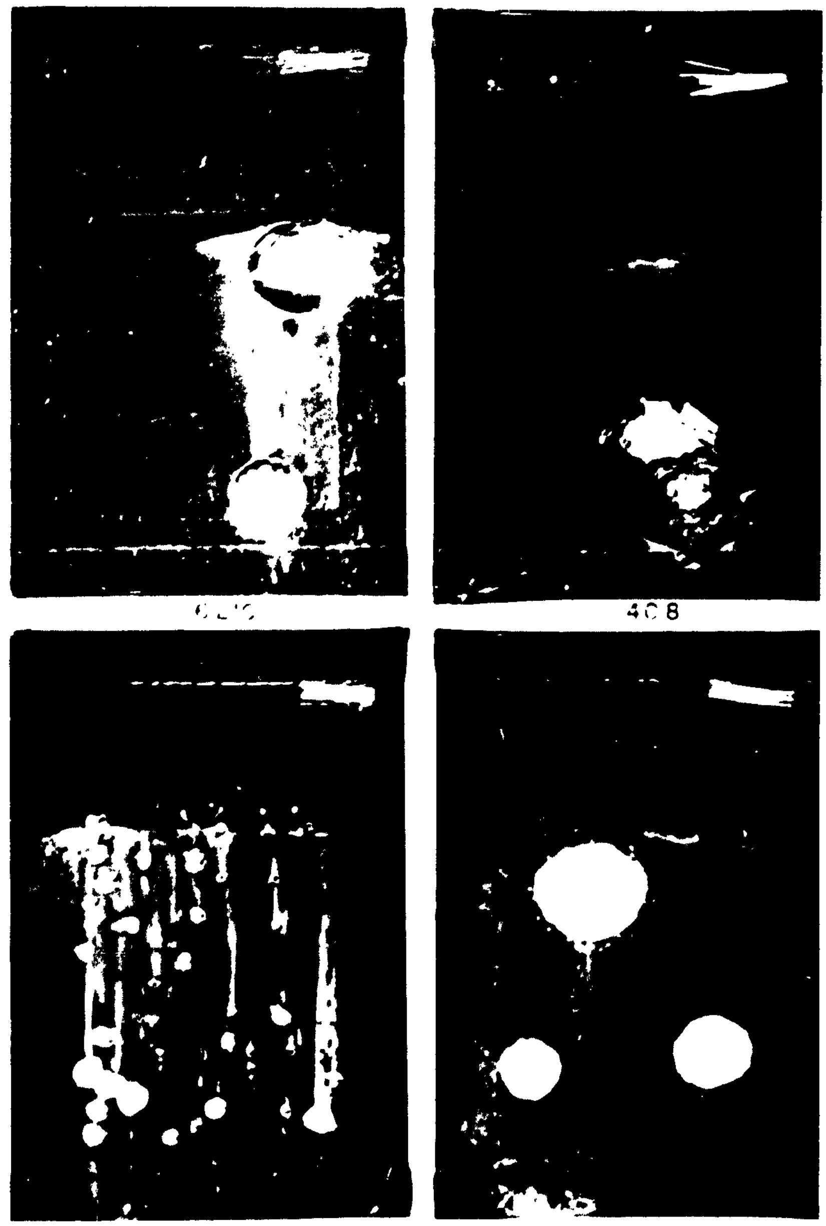
5% Salt Spray Testing of Olive Drab Coating Systems Using Conventional Primers

Primer Code	Topcoat Code	Adhesion	Results	Hours Tested
407	301-114-C	0	Many small blisters; corrosion on scribe.	200
621	301-114-C	0	Few small blisters, slight discoloration and corrosion.	400
408	301-114-C	-	Not Tested.	-
503	301-114-C	0	Slight corrosion; few very small blisters on scribe.	1200
407	301-115-A	0	Many small blisters, moderate corrosion, slight lifting, all on scribe.	2000
621	301-115-A	5	Many very small blisters, some lifting; very slight corrosion on scribe.	400
408	301-115-A	0	Slight corrosion and lifting on scribe.	2000
503	301-115-A	0	Many very small and few small blisters; slight corrosion and lifting on scribe.	600
407	301-134-A	0	Slight lifting; slight discoloration and corrosion on scribe.	2000
621	301-134-A	0	Few small blisters; slight discoloration and some corrosion on scribe.	2000
408	301-134-A	0	Many very small blisters; some corrosion and very slight lifting on scribe.	2000
503	301-134-A	0	Many very small blisters; slight lifting and severe corrosion on scribe.	1000
407	301-134-C	0	Two very small blisters; slight corrosion and discoloration on scribe.	2000
621	301-134-C	0	Many very small blisters; slight lifting and discoloration on scribe.	2000
408	301-134-C	0	Many very small blisters; very slight lifting and corrosion on scribe.	2000
503	301-134-C	0	Some very small blisters; slight corrosion and lifting on scribe.	1200
407	301-118-F	0	Few very small and many small blisters; slight corrosion and discoloration on scribe.	400
621	301-118-F	0	Few small blisters; slight corrosion and discoloration on scribe.	400
408	301-118-F	0	Very slight lifting and moderate corrosion on scribe.	2000
503	301-118-F	0	Few small blisters; slight lifting and some corrosion on scribe.	800

Adhesion Rating System

Rating	Description	Rating	Description
0	Excellent Adhesion	0	Excellent Adhesion
1	Less than 10% failure, topcoat from primer	1P	Less than 10% failure, primer from substrate
2	10-25% failure, topcoat from primer	2P	10-25% failure, primer from substrate
3	25-50% failure, topcoat from primer	3P	25-50% failure, primer from substrate
4	50-75% failure, topcoat from primer	4P	50-75% failure, primer from substrate
5	Complete lifting of topcoat from primer	5P	Complete lifting of primer from substrate

FIG. 9



407 503

Fig. 9

GALVANIC CORROSION TESTING OF COATING SYSTEMS USING SPECIFICATION PRIMERS.

B. Primers Containing Molybdate Pigments

During the course of the contract, a new series of corrosion inhibiting pigments became commercially available. These materials, made by Mineral Pigments Corporation, are calcium, strontium, and zinc molybdate. While they supposedly do an excellent job in the protection of ferrous substrates, no information was available regarding their effectiveness over magnesium. The following pigments were used:

1. 0820 calcium molybdate
2. 0830 zinc molybdate
3. 0838 strontium molybdate
4. 0821 calcium molybdate extended with calcium carbonate
5. 0831 zinc molybdate extended with calcium carbonate
6. 0839 strontium molybdate extended with calcium carbonate

The vehicles used were:

1. Midland R-55: Plaskon ST-847
2. Dow Corning XR-6-0000: Versamid 115

Pigment content was varied from 20 to 65% by weight.

It was found that several of these primers, particularly at low pigment loadings, performed well in the bimetallic corrosion test. The salt spray performance of these coatings, however, was extremely poor. The molybdate pigments, rather than having an inhibitory effect on corrosion, actually seemed to promote corrosion. Galvanic corrosion and salt spray testing results of molybdate primers can be found in Tables 64 and 65.

Table 64

Bimetallic Corrosion Testing of Molybdate Primers

Primer Code	Primer Vehicle	Pigment	Pigment Content	Rating
301-250-A	Midland R-55: Plaskon ST-856	#0820	35%	5
301-250-B	Midland R-55: Plaskon ST-856	#0830	35%	5
301-250-C	Midland R-55: Plaskon ST-856	#0838	35%	3
301-250-D	Midland R-55: Plaskon ST-856	#0821	35%	4
301-250-E	Midland R-55: Plaskon ST-856	#0831	35%	4
301-250-F	Midland R-55: Plaskon ST-856	#0839	35%	3
301-251-B	Dow Corning XR-6-0000:Versamid 115	#0820	65%	5
301-251-C	Dow Corning XR-6-0000: Versamid 115	#0820	50%	5
301-251-D	Dow Corning XR-6-0000: Versamid 115	#0820	35%	4
301-251-E	Dow Corning XR-6-0000: Versamid 115	#0820	20%	3
301-251-G	Dow Corning XR-6-0000: Versamid 115	#0830	65%	5
301-251-H	Dow Corning XR-6-0000: Versamid 115	#0830	50%	5
301-251-J	Dow Corning XR-6-0000: Versamid 115	#0830	35%	3
301-252-A	Dow Corning XR-6-0000: Versamid 115	#0830	20%	2
301-252-C	Dow Corning XR-6-0000: Versamid 115	#0838	65%	5
301-252-D	Dow Corning XR-6-0000: Versamid 115	#0838	50%	5
301-252-E	Dow Corning XR-6-0000: Versamid 115	#0838	35%	3
301-252-F	Dow Corning XR-6-0000: Versamid 115	#0838	20%	2
301-252-H	Dow Corning XR-6-0000: Versamid 115	#0821	65%	5
301-252-J	Dow Corning XR-6-0000: Versamid 115	#0821	50%	5
301-253-A	Dow Corning XR-6-0000: Versamid 115	#0821	35%	3
301-253-B	Dow Corning XR-6-0000: Versamid 115	#0821	20%	2
301-253-D	Dow Corning XR-6-0000: Versamid 115	#0831	65%	5
301-253-E	Dow Corning XR-6-0000: Versamid 115	#0831	50%	5
301-253-F	Dow Corning XR-6-0000: Versamid 115	#0831	35%	2
301-253-G	Dow Corning XR-6-0000: Versamid 115	#0831	20%	2

Table 64 (continued)

Bimetallic Corrosion Testing of Molybdate Primers

Primer Code	Primer Vehicle	Pigment	Pigment Content	Rating
301-253-J	Dow Corning XR-6-0000: Versamid 115	#0839	65%	5
301-254-A	Dow Corning XR-6-0000: Versamid 115	#0839	50%	5
301-254-B	Dow Corning XR-6-0000: Versamid 115	#0839	35%	3
301-254-C	Dow Corning XR-6-0000: Versamid 115	#0839	20%	3
301-258-A	Midland R-55: Plaskon ST-847	#0830	20%	4

Bimetallic Corrosion Rating System

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 65

5% Salt Spray Testing of Molybdate Primers

Primer Code	Results	Hours Tested
301-250-A	Severely corroded.	120
301-250-B	Severely corroded.	120
301-250-C	Severely corroded on scribe.	800
301-250-D	Severely corroded.	800
301-250-E	Severely corroded.	400
301-250-F	Severely corroded.	400
301-251-B	Severely corroded.	24
301-251-C	Severely corroded.	24
301-251-D	Severely corroded.	100
301-251-E	Severely corroded.	200
301-251-G	Severely corroded.	24
301-251-H	Severely corroded.	24
301-251-J	Severely corroded.	24
301-252-A	Severely corroded.	24
301-252-C	Severely corroded.	24
301-252-D	Severely corroded.	48
301-252-E	Severely corroded.	96
301-252-F	Severely corroded.	360
301-252-H	Severely corroded.	24
301-252-J	Severely corroded.	24
301-253-A	Severely corroded.	48
301-253-B	Many small and few medium blisters; severe corrosion on scribe.	1000
301-253-D	Severely corroded.	24
301-253-E	Severely corroded.	24
301-253-F	Many small blisters and severe corrosion on scribe.	600
301-253-G	Some medium blisters, moderate corrosion, and lifting, all on scribe.	800

Table 65 (continued)

5% Salt Spray Testing of Molybdate Primers

Primer Code	Results	Hours Tested
301-253-J	Severely corroded.	120
301-254-A	Severely corroded.	120
301-254-B	Many very small blisters, slight corrosion and lifting on scribe.	1200
301-254-C	Some very small and many small blisters, moderate corrosion on scribe.	1400
301-258-A	Severely corroded.	120

Although the salt spray performance of the molybdate primers was poor, it was decided to try a few of them under some of the better topcoats. The following were chosen:

1. 301-252-F
2. 301-253-B
3. 301-253-G

Topcoats used for this program were:

1. 301-118-F
2. 301-175-B
3. 301-114-C
4. 301-134-A
5. 301-204-A
6. 301-163-B (white)

The coating systems using the molybdate primers were fair in the bimetallic corrosion test but performed poorly in the salt spray. These primers were eliminated from further testing. Galvanic corrosion and salt spray results can be found in Tables 66 and 67.

C. Comparison of Zinc Chromate Pigments from Various Suppliers

Midland R-55: Plaskon ST-847 primers were made from zinc chromate pigments obtained from the following suppliers:

1. Imperical Color, Chemical & Paper Corp.
2. Reichhold Chemicals, Inc.
3. Western Dry Color Company

4. Kentucky Color & Chemical Company

5. DuPont

Bimetallic corrosion tests performed on panels coated with these primers indicated no substantial differences in these pigments as far as their performance in this coating was concerned.

Table 66

Bimetallic Corrosion Testing of Coating Systems Using Molybdate Primers

Primer Code	Topcoat Code	Topcoat Vehicle	Rating
301-252-F	301-118-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	3
301-253-B	301-118-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	2
301-253-G	301-118-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	2
301-252-F	301-175-B	Midland R-55	2
301-253-B	301-175-B	Midland R-55	3
301-253-G	301-175-B	Midland R-55	3
301-252-F	301-114-C	Dow Corning R-6-0031: Bakelite BRS-2600	2
301-253-B	301-114-C	Dow Corning R-6-0031: Bakelite BRS-2600	2
301-253-G	301-114-C	Dow Corning R-6-0031: Bakelite BRS-2600	2
301-252-F	301-134-A	Midland X-4209: Versamid 115	3
301-253-B	301-134-A	Midland X-4209: Versamid 115	3
301-253-G	301-134-A	Midland X-4209: Versamid 115	3
301-252-F	301-204-A	Midland X-4282	3
301-253-B	301-204-A	Midland X-4282	2
301-253-G	301-204-A	Midland X-4282	2
301-252-F	301-163-B	Dow Corning R-6-0031: ½" RS Nitrocellulose	3
301-253-B	301-163-B	Dow Corning R-6-0031: ½" RS Nitrocellulose	3
301-253-G	301-163-B	Dow Corning R-6-0031: ½" RS Nitrocellulose	3

Bimetallic Corrosion Rating System

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 67

5% Salt Spray Testing of Coating Systems Using Molybdate Primers

Primer Code	Topcoat Code	Adhesion	Results	Hours Tested
301-252-F	301-118-F	Not tested	Some very small blisters, severely corroded.	1000
301-253-B	301-118-F	Not tested	Many small blisters, severely corroded.	1200
301-253-G	301-118-F	Not tested	Few very small blisters, severely corroded.	1200
301-252-F	301-175-B	Not tested	Some very small blisters, severely corroded.	1200
301-253-B	301-175-B	Not tested	Some very small blisters, severely corroded.	1200
301-253-G	301-175-I	Not tested	Some very small blisters, severely corroded.	1200
301-252-F	301-114-C	Not tested	Many small and few medium blisters.	400
301-253-B	301-114-C	Not tested	Many small and very small blisters.	600
301-253-G	301-114-C	Not tested	Many small blisters.	400
301-252-F	301-134-A	Not tested	Many very small blisters, severely corroded.	1000
301-253-B	301-134-A	Not tested	Many very small blisters, severely corroded.	1000
301-253-G	301-134-A	Not tested	Many very small blisters, severely corroded.	1000
301-252-F	301-204-A	Not tested	Many very small blisters, severely corroded.	1000
301-253-B	301-204-A	Not tested	Many very small blisters, severely corroded.	1000
301-253-G	301-204-A	Not tested	Many very small blisters, severely corroded.	1000
301-252-F	301-163-B	Not tested	Severely corroded.	1000
301-253-B	301-163-B	Not tested	Some very small blisters, severely corroded.	1000
301-253-G	301-163-B	Not tested	Severely corroded.	1000

D. Effect of Extender Pigments on Primer Performance

Earlier in the contract, small amounts of extender pigments were added to some primers to determine the effect of the inerts on bimetallic corrosion resistance. No topcoats were used. The primers containing the inert pigments were far inferior in performance to the same coatings without the inerts.

It was believed worthwhile testing the two best primers, with and without extender pigments, under some of the better topcoats. The following primers were used:

1. 301-103-A zinc chromate primer
2. 301-124-H zinc chromate primer with extender pigments
3. 301-131-B calcium chromate primer
4. 301-232-H calcium chromate primer with extender pigments

The first two primers above have Midland R-55: Plaskon ST-847 as the vehicle while the other remaining two coatings contain a Dow Corning XR-6-0000: Versamid 115 vehicle. The following topcoats were used over each primer:

1. 301-115-A
2. 301-134-A
3. 301-175-A
4. 301-175-C
5. 301-222-A
6. 301-183-B (white)

The results of the testing of this series are very similar to those obtained when only the primers were tested, namely, systems using primers containing no extender pigments performed much better than systems using primers with inert pigments. Results of salt spray and bimetallic corrosion testing can be found in Tables 68 and 69. (See fig. 10)

E. Effect of Tri-butyl Tin Oxide on Galvanic Corrosion Resistance

Tri-butyl tin oxide supposedly has an inhibitory effect on the corrosion of magnesium. Small amounts of TBTO were, therefore, added to the 301-131-B calcium chromate primer. Similar additions of TBTO to the 301-103-A zinc chromate primer produced incompatibility and gelation. The results of the testing of coatings containing TBTO seem to indicate that for this particular coating, the addition of TBTO accelerates rather than inhibits corrosion. Salt spray and bimetallic corrosion results are listed in Tables 70 and 71.

Table 68

Bimetallic Corrosion Testing of Coating Systems Using Primers Containing Extender Pigments

Primer Code	Topcoat Code	Topcoat Vehicle	Rating
301-103-A	301-115-A	Midland R-55: Plaskon ST-847	0
301-124-H	301-115-A	Midland R-55: Plaskon ST-847	5
301-131-B	301-115-A	Midland R-55: Plaskon ST-847	1
301-232-H	301-115-A	Midland R-55: Plaskon ST-847	3
301-103-A	301-134-A	Midland X-4209: Versamid 115	1
301-124-H	301-134-A	Midland X-4209: Versamid 115	4
301-131-B	301-134-A	Midland X-4209: Versamid 115	3
301-232-H	301-134-A	Midland X-4209: Versamid 115	3
301-103-A	301-175-A	Midland X-4263	1
301-124-H	301-175-A	Midland X-4263	4
301-131-B	301-175-A	Midland X-4263	3
301-232-H	301-175-A	Midland X-4263	4
301-103-A	301-175-C	Midland X-4271	2
301-124-H	301-175-C	Midland X-4271	4
301-131-B	301-175-C	Midland X-4271	2
301-232-H	301-175-C	Midland X-4271	3
301-103-A	301-222-A	Midland X-4300	2
301-124-H	301-222-A	Midland X-4300	3
301-131-B	301-222-A	Midland X-4300	2
301-232-H	301-222-A	Midland X-4300	2

Table 68 (continued)

Bimetallic Corrosion Testing of Coating Systems Using Primers Containing Extender Pigments

Primer Code	Topcoat Code	Topcoat Vehicle	Rating
301-103-A	301-183-B	Epon 1001: Dow Corning Z-6020	3
301-124-H	301-183-B	Epon 1001: Dow Corning Z-6020	3
301-131-B	301-183-B	Epon 1001: Dow Corning Z-6020	1
301-232-H	301-183-B	Epon 1001: Dow Corning Z-6020	2

Bimetallic Corrosion Rating System

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 69

5% Salt Spray Testing of Coating Systems Using Primers Containing Extender Pigments

Primer Code	Topcoat Code	Adhesion	Results	Hours Tested
301-103-A	301-115-A	5	Slight corrosion and one medium blister on scribe.	2000
301-124-H	301-115-A	3	One medium and few small blisters, slight lifting and moderate corrosion, all on scribe.	2000
301-131-B	301-115-A	2	Very slight lifting on scribe.	2000
301-232-H	301-115-A	0	Few small and one medium blister, slight lifting and corrosion, all on scribe.	2000
301-103-A	301-134-A	0	Few small blisters and slight lifting on scribe.	2000
301-124-H	301-134-A	0	Some very small blisters; one medium blister, moderate corrosion and slight lifting on scribe.	2000
301-131-B	301-134-A	0	Very slight lifting and few very small blisters on scribe.	2000
301-232-H	301-134-A	0	Some very small blisters; two medium blisters, slight corrosion and lifting on scribe.	2000
301-103-A	301-175-A	5	Slight corrosion on scribe.	2000
301-124-H	301-175-A	0	Many small blisters, slight corrosion and lifting, all on scribe.	2000
301-131-B	301-175-A	1	Few very small blisters and slight corrosion on scribe.	2000
301-232-H	301-175-A	0	Few small and one medium blister, slight corrosion and lifting, all on scribe.	2000
301-103-A	301-175-C	5	Slight lifting and corrosion on scribe.	2000
301-124-H	301-175-C	3	Two medium blisters; few small blisters, slight corrosion and lifting on scribe.	2000
301-131-B	301-175-C	5	Two small blisters, very slight lifting and corrosion, all on scribe.	2000
301-232-H	301-175-C	0	Many very small blisters; few small blisters, slight corrosion and lifting on scribe.	2000
301-103-A	301-222-A	5	Very few small blisters and slight corrosion on scribe.	2000
301-124-H	301-222-A	1	Slight corrosion and lifting on scribe.	2000
301-131-B	301-222-A	5	Few small and one medium blister, slight lifting and corrosion, all on scribe.	2000
301-232-H	301-222-A	0	Few small blisters, slight lifting and corrosion, all on scribe.	2000

Table 69 (continued)

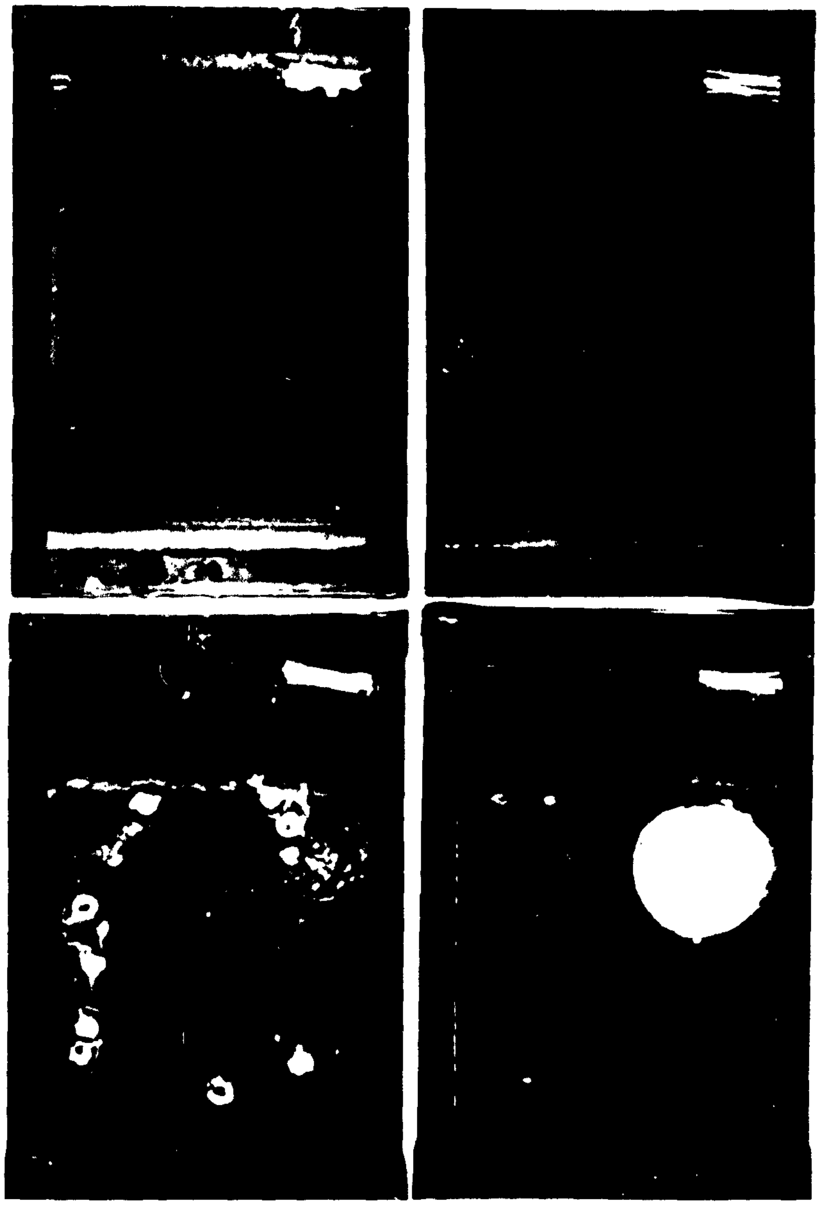
5% Salt Spray Testing of Coating Systems
Using Primers Containing Extender Pigments

Primer Code	Topcoat Code	Adhesion	Results	Hours Tested
301-103-A	301-183-B	1	Completely unaffected.	2000
301-124-H	301-183-B	0	Few small blisters; slight lifting and very slight corrosion on scribe.	2000
301-131-B	301-183-B	0	Very slight corrosion on scribe.	2000
301-232-H	301-183-B	0	Few very small blisters; many very small blisters and slight corrosion on scribe.	2000

Adhesion Rating System

Rating	Description	Rating	Description
0	Excellent Adhesion	0	Excellent Adhesion
1	Less than 10% failure, topcoat from primer	1P	Less than 10% failure, primer from substrate
2	10-25% failure, topcoat from primer	2P	10-25% failure, primer from substrate
3	25-50% failure, topcoat from primer	3P	25-50% failure, primer from substrate
4	50-75% failure, topcoat from primer	4P	50-75% failure, primer from substrate
5	Complete lifting of topcoat from primer	5P	Complete lifting of primer from substrate

FIG. 10



RESULTS OF ADDING INERT PIGMENTS TO PRIMERS
C = INERTS ADDED A = WITHOUT

Fig. 10

EFFECT OF ADDITION OF INERT PIGMENT TO PRIMERS OF PREFERRED COATING SYSTEMS

Table 70

Effect of Tributyl Tin Oxide on Bimetallic Corrosion

Primer Code	Vehicle	% TBTO Based on Total Weight	Rating
301-131-B	Dow Corning XR-6-0000: Versamid 115	0	2
301-267-E	Dow Corning XR-6-0000: Versamid 115	1	2
301-267-F	Dow Corning XR-6-0000: Versamid 115	2	3
301-267-G	Dow Corning XR-6-0000: Versamid 115	5	3
301-267-H	Dow Corning XR-6-0000: Versamid 115	10	3

Bimetallic Corrosion Rating System

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 71

5% Salt Spray Testing of Primers Containing Tributyl Tin Oxide

Primer Code	Results	Hours Tested
301-131-B	Few very small and some small blisters.	2000
301-267-E	Some small blisters and slight corrosion on scribe.	2000
301-267-F	Many small blisters and slight corrosion on scribe.	2000
301-267-G	Some very small blisters; slight corrosion on scribe.	2000
301-267-H	One small and some very small blisters; many small blisters and slight corrosion on scribe.	2000

F. Evaluation of Previously Eliminated Primers

Since all evaluation of complete coating systems had been conducted using only two primers, it was decided to test some of the better topcoats over some previously eliminated primers. It was also decided to include some of the primers which were developed later in the contract and never tested under topcoats. The primers chosen for this study were:

	Primer Code	Vehicle	Pigment
1.	301-106-A	Epon 1001: Versamid 115	$ZnCrO_4$
2.	301-106-G	Epon 1001: Versamid 115	$CaCrO_4$
3.	301-106-K	Epon 1001: Diethylene Triamine	$CaCrO_4$
4.	301-107-A	Epon 1009: Versamid 115	$ZnCrO_4$
5.	301-102-D	Kel F Fluorel: Acryloid A-101	$ZnCrO_4$
6.	301-158-L	Midland X-4245	$ZnCrO_4$
7.	301-159-D	Midland X-4271	$ZnCrO_4$
8.	301-188-C	Epon 1001: Snell H-1	$CaCrO_4$
9.	301-202-A	Midland X-4283	$ZnCrO_4$
10.	301-158-C	Midland X-4240	$CaCrO_4$
11.	301-159-G	Midland X-4282	$ZnCrO_4$
12.	301-232-E	Midland X-4316: Versamid 115	$CaCrO_4$

The topcoats used were:

1. 301-175-B Olive Drab
2. 301-118-F Olive Drab
3. 301-114-C Olive Drab
4. 301-134-A Olive Drab
5. 301-134-C Olive Drab
6. 301-163-B White

As usual, both bimetallic corrosion and salt spray resistance of these coating systems was determined. All of these systems, as can be seen from Tables 72 and 73, were inferior to the best coating systems and were eliminated from further consideration.

Table 72

Bimetallic Corrosion Testing of Coating Systems Using Previously Eliminated Primers

Primer Code	Topcoat Code	Topcoat Vehicle	Rating
301-106-A	301-175-B	Midland R-55	3
301-106-G	301-175-B	Midland R-55	2
301-106-K	301-175-B	Midland R-55	4
301-107-A	301-175-B	Midland R-55	2
301-102-D	301-175-B	Midland R-55	3
301-158-L	301-175-B	Midland R-55	2
301-159-D	301-175-B	Midland R-55	2
301-188-C	301-175-B	Midland R-55	3
301-202-A	301-175-B	Midland R-55	3
301-159-G	301-175-B	Midland R-55	3
301-106-A	301-118-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	4
301-106-G	301-118-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	4
301-106-K	301-118-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	3
301-107-A	301-118-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	3
301-102-D	301-118-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	3
301-158-L	301-118-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	3
301-159-D	301-118-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	3
301-188-C	301-118-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	4
301-202-A	301-118-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	3
301-158-C	301-118-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	1
301-159-G	301-118-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	2
301-232-E	301-118-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	2
301-106-A	301-114-C	Dow Corning R-6-0031: Bakelite BRS-2600	5
301-106-G	301-114-C	Dow Corning R-6-0031: Bakelite BRS-2600	3
301-106-K	301-114-C	Dow Corning R-6-0031: Bakelite BRS-2600	5
301-107-A	301-114-C	Dow Corning R-6-0031: Bakelite BRS-2600	5
301-102-D	301-114-C	Dow Corning R-6-0031: Bakelite BRS-2600	4
301-158-L	301-114-C	Dow Corning R-6-0031: Bakelite BRS-2600	5

Table 72 (continued)

Bimetallic Corrosion Testing of Coating Systems Using Previously Eliminated Primers

Primer Code	Topcoat Code	Topcoat Vehicle	Rating
301-159-D	301-114-C	Dow Corning R-6-0031: Bakelite BRS-2600	5
301-188-C	301-114-C	Dow Corning R-6-0031: Bakelite BRS-2600	5
301-202-A	301-114-C	Dow Corning R-6-0031: Bakelite BRS-2600	4
301-232-E	301-114-C	Dow Corning R-6-0031: Bakelite BRS-2600	2
301-106-A	301-134-A	Midland X-4209: Versamid 115	3
301-106-G	301-134-A	Midland X-4209: Versamid 115	3
301-106-K	301-134-A	Midland X-4209: Versamid 115	5
301-107-A	301-134-A	Midland X-4209: Versamid 115	4
301-102-D	301-134-A	Midland X-4209: Versamid 115	3
301-158-L	301-134-A	Midland X-4209: Versamid 115	3
301-159-D	301-134-A	Midland X-4209: Versamid 115	3
301-188-C	301-134-A	Midland X-4209: Versamid 115	4
301-202-A	301-134-A	Midland X-4209: Versamid 115	3
301-158-C	301-134-A	Midland X-4209: Versamid 115	2
301-159-G	301-134-A	Midland X-4209: Versamid 115	2
301-232-E	301-134-A	Midland X-4209: Versamid 115	2
301-106-A	301-134-C	Dow Corning XR-6-0000: Versamid 115	3
301-106-G	301-134-C	Dow Corning XR-6-0000: Versamid 115	4
301-106-K	301-134-C	Dow Corning XR-6-0000: Versamid 115	5
301-107-A	301-134-C	Dow Corning XR-6-0000: Versamid 115	4
301-102-D	301-134-C	Dow Corning XR-6-0000: Versamid 115	3
301-158-L	301-134-C	Dow Corning XR-6-0000: Versamid 115	4
301-159-D	301-134-C	Dow Corning XR-6-0000: Versamid 115	4
301-188-C	301-134-C	Dow Corning XR-6-0000: Versamid 115	4
301-202-A	301-134-C	Dow Corning XR-6-0000: Versamid 115	3
301-158-C	301-134-C	Dow Corning XR-6-0000: Versamid 115	1
301-159-G	301-134-C	Dow Corning XR-6-0000: Versamid 115	2

Table 72 (continued)

Bimetallic Corrosion Testing of Coating Systems Using Previously Eliminated Primers

Primer Code	Topcoat Code	Topcoat Vehicle	Rating
301-106-A	301-163-B	Dow Corning R-6-0031: ½" RS Nitrocellulose	5
301-106-G	301-163-B	Dow Corning R-6-0031: ½" RS Nitrocellulose	4
301-106-K	301-163-B	Dow Corning R-6-0031: ½" RS Nitrocellulose	5
301-107-A	301-163-B	Dow Corning R-6-0031: ½" RS Nitrocellulose	5
301-102-D	301-163-B	Dow Corning R-6-0031: ½" RS Nitrocellulose	N.T.
301-158-L	301-163-B	Dow Corning R-6-0031: ½" RS Nitrocellulose	N.T.
301-159-D	301-163-B	Dow Corning R-6-0031: ½" RS Nitrocellulose	N.T.
301-188-C	301-163-B	Dow Corning R-6-0031: ½" RS Nitrocellulose	5
301-202-A	301-163-B	Dow Corning R-6-0031: ½" RS Nitrocellulose	N.T.

Bimetallic Corrosion Rating System

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 73

5% Salt Spray Testing of Coating Systems Using Previously Eliminated Primers

Primer Code	Topcoat Code	Adhesion	Results	Hours Tested
301-106-A	301-175-B	0	Some very small blisters; one medium blister and slight corrosion on scribe.	2000
301-106-G	301-175-B	0	Some very small blisters; one medium blister and slight corrosion on scribe.	2000
301-106-K	301-175-B	0	Many very small blisters; few small blisters and slight corrosion on scribe.	2000
301-107-A	301-175-B	2P	Many very small blisters; one medium and few small blisters, slight corrosion and lifting on scribe.	2000
301-102-D	301-175-B	0	Many very small and some small blisters; slight corrosion on scribe.	2000
301-158-L	301-175-B	0	Many very small blisters; one medium blister and moderate corrosion on scribe.	2000
301-159-D	301-175-B	0	Many very small and some small blisters; some small blisters, slight corrosion and lifting on scribe.	2000
301-188-C	301-175-B	0	Many very small blisters; some small blisters, slight corrosion and lifting on scribe.	2000
301-202-A	301-175-B	0	Many very small blisters; few small blisters and slight corrosion on scribe.	2000
301-159-G	301-175-B	0	One small blister, moderate corrosion, slight lifting, all on scribe.	2000
301-106-A	301-118-F	1P	Some very small blisters; few small blisters, slight corrosion and lifting on scribe.	2000
301-106-G	301-118-F	0	Many very small blisters; few small blisters and slight corrosion on scribe.	2000
301-106-K	301-118-F	1P	Many very small and few medium blisters; slight corrosion and lifting on scribe.	2000
301-107-A	301-118-F	0	Many very small blisters; few small blisters and slight corrosion on scribe.	2000
301-102-D	301-118-F	0	Many very small blisters; few small blisters and slight corrosion on scribe.	2000
301-158-L	301-118-F	0	Many very small blisters; few small blisters, slight corrosion and lifting on scribe.	2000
301-159-D	301-118-F	5	Many very small blisters; few small blisters, slight corrosion and lifting on scribe.	2000
301-188-C	301-118-F	0	Many very small blisters; few small blisters, slight corrosion and lifting on scribe.	2000
301-202-A	301-118-F	0	Many very small blisters; few small blisters and slight corrosion on scribe.	2000
301-158-C	301-118-F	5	Some very small blisters; slight corrosion and slight lifting on scribe.	2000
301-159-G	301-118-F	0	Few small blisters, slight corrosion; slight lifting on scribe.	2000
301-232-E	301-118-F	0	Some small and two medium blisters, slight corrosion and lifting, all on scribe.	2000

Table 73 (continued)

5% Salt Spray Testing of Coating Systems Using Previously Eliminated Primers

Primer Code	Topcoat Code	Adhesion	Results	Hours Tested
301-106-A	301-114-C	0	Many small and very small blisters; slight corrosion on scribe.	400
301-106-G	301-114-C	0	Many small and very small blisters.	400
301-106-K	301-114-C	0	Many small and very small blisters; slight corrosion on scribe.	400
301-107-A	301-114-C	2P	Many small and very small blisters; slight corrosion on scribe.	400
301-102-D	301-114-C	0	Many small and very small blisters; slight corrosion on scribe.	2000
301-158-L	301-114-C	0	Many very small blisters; slight corrosion on scribe.	400
301-159-D	301-114-C	0	Many very small blisters; few small and two medium blisters, slight corrosion on scribe.	2000
301-188-C	301-114-C	0	Many small blisters; slignt corrosion on scribe.	400
301-202-A	301-114-C	0	Many very small blisters; slight corrosion on scribe.	2000
301-232-E	301-114-C	0	Many very small and few medium blisters.	2000
301-106-A	301-134-A	0	Some very small blisters; few small blisters, slight corrosion and lifting on scribe.	2000
301-106-G	301-134-A	0	Many very small blisters; few small and medium blisters, slight corrosion and lifting on scribe.	2000
301-106-K	301-134-A	3P	Many very small and few small blisters; slight corrosion and lifting on scribe.	2000
301-107-A	301-134-A	3P	Few very small blisters; few small and medium blisters, slight corrosion and lifting on scribe.	2000
301-102-D	301-134-A	0	Many very small blisters; few small blisters, slight corrosion and lifting on scribe.	2000
301-158-L	301-134-A	0	Many very small blisters; few small and medium blisters, slight corrosion and lifting on scribe.	2000
301-159-D	301-134-A	0	Some very small blisters; few small blisters, slight corrosion and lifting on scribe.	2000
301-188-C	301-134-A	0	Many very small blisters; few small blisters, slight corrosion and lifting on scribe.	2000
301-202-A	301-134-A	0	One medium and many very small blisters; many small blisters, slight corrosion and lifting on scribe.	2000
301-158-C	301-134-A	0	Some very small blisters; slight corrosion and lifting on scribe.	2000
301-159-G	301-134-A	0	Many very small blisters; slight lifting and moderate corrosion on scribe.	2000
301-232-E	301-134-A	0	Few very small blisters; two medium blisters, slight corrosion and lifting on scribe.	2000

Table 73 (continued)

5% Salt Spray Testing of Coating Systems Using Previously Eliminated Primers

Primer Code	Topcoat Code	Adhesion	Results	Hours Tested
301-106-A	301-134-C	0	Some very small blisters; few small blisters and slight corrosion on scribe.	2000
301-106-G	301-134-C	0	Many very small blisters; few small blisters and slight corrosion on scribe.	2000
301-106-K	301-134-C	0	Many very small blisters; few small blisters, slight corrosion and lifting on scribe.	2000
301-107-A	301-134-C	1P	Few very small blisters; few small blisters, slight corrosion and lifting on scribe.	2000
301-102-D	301-134-C	0	Many very small blisters; few small blisters, slight corrosion and lifting on scribe.	2000
301-158-L	301-134-C	0	Many very small blisters; one medium and few small blisters, slight corrosion and lifting on scribe.	2000
301-159-D	301-134-C	0	Some very small blisters; one medium and few small blisters, slight corrosion and lifting on scribe.	2000
301-188-C	301-134-C	0	Few small blisters; few small blisters, slight lifting and corrosion on scribe.	2000
301-202-A	301-134-C	0	Many very small blisters; few small blisters and slight corrosion on scribe.	2000
301-158-C	301-134-C	0	Some very small blisters; slight corrosion and lifting on scribe.	2000
301-159-G	301-134-C	0	Many very small and one medium blister; slight lifting and moderate corrosion on scribe.	2000
301-106-A	301-163-B	0	Few small blisters and slight corrosion on scribe.	2000
301-106-G	301-163-B	0	Many very small blisters; slight corrosion on scribe.	2000
301-106-K	301-163-B	0	Many very small and few small blisters; slight corrosion on scribe.	2000
301-107-A	301-163-B	4P	Many very small blisters; few small blisters and slight corrosion on scribe.	2000
301-102-D	301-163-B	-	Not Tested.	-
301-158-L	301-163-B	-	Not Tested.	-
301-159-D	301-163-B	-	Not Tested.	-
301-188-C	301-163-B	0	Many very small and few small blisters; slight corrosion on scribe.	2000
301-202-A	301-163-B	-	Not Tested.	-

Adhesion Rating System

Rating	Description	Rating	Description
0	Excellent Adhesion	0	Excellent Adhesion
1	Less than 10% failure, topcoat from primer	1P	Less than 10% failure, primer from substrate
2	10-25% failure, topcoat from primer	2P	10-25% failure, primer from substrate
3	25-50% failure, topcoat from primer	3P	25-50% failure, primer from substrate
4	50-75% failure, topcoat from primer	4P	50-75% failure, primer from substrate
5	Complete lifting of topcoat from primer	5P	Complete lifting of primer from substrate

G. Primers Containing Miscellaneous Vehicles

During the course of the contract, a number of miscellaneous vehicles were tested. Some of these materials passed initial screening tests in clear films and were incorporated into primers. These resin systems were:

1. Midland X-3928 - a silicone copolymer.
2. Dow Corning R-6-0031: Mondur CB-75 - This vehicle is the same as one of the better vehicles but the Multron R-16 polyester was eliminated.
3. Midland X-4415 - a silicone copolymer.
4. Midland X-4323 - a silicone copolymer.
5. ADM Aroflint 202-XA1-60: 303-X-90.
6. Cargill 1459 Polyurethane Oil.
7. Midland X-3934 - a urethane prepolymer.

None of these primers were considered good enough to warrant further investigation. Bimetallic corrosion and salt spray results can be found in Tables 74 and 75.

H. Reformulation of 301-131-B Primer

One of the problems with the 301-131-B primer was the extremely hard settling of the pigment. A small amount of Bentone 27 was added to correct this condition. The code for the reformulated primer was 301-271-D.

It was then discovered that the General Electric SR-82 which was added as a flow control agent was absorbed by the pigment, eventually causing a flow problem. This was corrected by putting the SR-82 into the catalyst system. The code for the final revised formula is 301-275-E. No change in performance of the primer was noticed as these changes were made.

Table 74

Bimetallic Corrosion Testing of Primers Using Miscellaneous Vehicles

Primer Code	Primer Vehicle	Pigment	Rating
301-203-H	Midland X-3928	Zinc Chromate	4
301-233-B	Dow Corning R-6-0031: Mondur CB-75	Zinc Chromate	3
301-274-D	Cargill 1459 Polyurethane Oil	Zinc Chromate	3
301-274-E	Cargill 1459 Polyurethane Oil	Calcium Chromate	3
301-321-B	Midland X-4415	Zinc Chromate	3
301-321-C	Midland X-4415	Calcium Chromate	3
301-348-C	Midland X-4323: Midland X-3934	Zinc Chromate	3
301-348-D	Midland X-4323: Midland X-3934	Calcium Chromate	3
301-348-E	Midland X-4323: Mondur CB-75	Zinc Chromate	3
301-348-F	Midland X-4323: Mondur CB-75	Calcium Chromate	3
301-434-D	Aroflint 202-XA1-60: Aroflint 303-X-90	Calcium Chromate	5

Bimetallic Corrosion Rating System

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 75

5% Salt Spray Testing of Primers Using Miscellaneous Vehicles

Primer Code	Results	Hours Tested
301-203-H	Many very small blisters and slight corrosion.	800
301-233-B	Some small blisters; many small blisters and slight corrosion on scribe.	2000
301-274-D	Many small and very small blisters, some corrosion.	400
301-274-E	Some very small blisters; slight corrosion on scribe.	2000
301-321-B	Many very small and some small blisters; slight corrosion on scribe.	2000
301-321-C	Many very small and some small blisters; slight corrosion on scribe.	2000
301-348-C	Many very small blisters, slight corrosion.	2000
301-348-D	Some small and very small blisters; slight corrosion on scribe.	2000
301-348-E	Many small and very small blisters; slight corrosion on scribe.	2000
301-348-F	Some very small blisters; some small blisters and slight corrosion on scribe.	2000
301-434-D	Some small and very small blisters, slight corrosion.	2000

Section X

Miscellaneous Olive Drab Topcoat Work

A. Reformulation of Olive Drab Topcoats to Match Color #X-24087.

During the course of the contract, it was decided the color of the olive drab topcoat should match color chip #X-24087 rather than #2430. This color was obtained by deleting the titanium dioxide from the original pigmentation and shading the resulting color. The formula codes for the shaded systems are as follows:

#2430	#X-24087
301-114-C	301-264-B
301-175-B	301-270-C
301-118-F	301-284-D
301-134-A	301-278-E
301-134-C	301-278-C

In addition to matching the new color, these formulations were corrected to the proper gloss.

B. Corrosion Resistance of Reformulated Olive Drab Topcoats

It was decided to compare the reformulated topcoats with the original coatings. In addition, the effect of some variations in pigment volume concentration were evaluated. The coatings tested and their variables were:

		R-6-0031 Multron R-16 Mondur CB-75	Midland R-55	R-6-0031 BRS-2600
1.	Original PVC, color #2430	301-118-F	301-175-B	301-114-C
2.	Original PVC, color #X-24087	301-312-D	301-314-A	301-315-A
3.	Original PVC, color #X-24087, without inert pigments	301-313-B	301-314-B	301-315-B
4.	New PVC, color #2430	301-312-B	301-313-C	301-314-C
5.	New PVC, color #X-24087	301-284-D	301-270-C	301-264-B

It can be seen from Table 76 that there was very little change in galvanic corrosion resistance when the olive drab coatings were reformulated.

At the time of this test, it was noted that there was considerable variation in the appearance of the Dow 17 treated panels. Some of the panels had a uniform appearance while others looked spotty. Each of these coatings was tested on both types of substrate. Neither substrate was consistently better than the other. No salt spray tests were performed.

Table 76

Bimetallic Corrosion Testing of Reformulated Olive Drab Topcoats

Primer Code	Topcoat Code	Topcoat Vehicle	Rating
301-103-A	301-175-B	Midland R-55	1
301-103-A	301-314-A	Midland R-55	2
301-103-A	301-314-B	Midland R-55	2
301-103-A	301-313-C	Midland R-55	2
301-103-A	301-270-C	Midland R-55	2
301-275-E	301-175-B	Midland R-55	2
301-275-E	301-314-A	Midland R-55	2
301-275-E	301-314-B	Midland R-55	1
301-275-E	301-313-C	Midland R-55	2
301-275-E	301-270-C	Midland R-55	1
301-103-A	301-118-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	2
301-103-A	301-312-D	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	2
301-103-A	301-313-B	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	2
301-103-A	301-312-B	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	2
301-103-A	301-284-D	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	2
301-275-E	301-118-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	1
301-275-E	301-312-D	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	2
301-275-E	301-313-B	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	1
301-275-E	301-312-B	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	2
301-275-E	301-284-D	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	1

Table 76 (continued)

Bimetallic Corrosion Testing of Reformulated Olive Drab Topcoats

Primer Code	Topcoat Code	Topcoat Vehicle	Rating
301-103-A	301-114-C	Dow Corning R-6-0031: Bakelite BRS-2600	3
301-103-A	301-315-A	Dow Corning R-6-0031: Bakelite BRS-2600	3
301-103-A	301-315-B	Dow Corning R-6-0031: Bakelite BRS-2600	N.T.
301-103-A	301-314-C	Dow Corning R-6-0031: Bakelite BRS-2600	3
301-103-A	301-264-B	Dow Corning R-6-0031: Bakelite BRS-2600	3
301-275-E	301-114-C	Dow Corning R-6-0031: Bakelite BRS-2600	2
301-275-E	301-315-A	Dow Corning R-6-0031: Bakelite BRS-2600	2
301-275-E	301-315-B	Dow Corning R-6-0031: Bakelite BRS-2600	N.T.
301-275-E	301-314-C	Dow Corning R-6-0031: Bakelite BRS-2600	2
301-275-E	301-264-B	Dow Corning R-6-0031: Bakelite BRS-2600	2

Bimetallic Corrosion Rating System

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

C. Alternate Olive Drab Pigmentation

An alternate form of pigmentation was tried using the Midland R-55: Plaskon ST-847 vehicle. The following pigment system was used:

Graphite	17.4%
Mapico #20	17.7%
Cadmium lithopone	24.7%
Talc	40.2%
	100.0%

Coatings with pigment contents of 40 and 60% were evaluated. Since no improvements were gained using this pigmentation, the original pigment system was used for the remainder of the contract.

D. Addition of Wax to Olive Drab Topcoats

Since wax had been so effective in preventing corrosion of the edges of the panels, it was decided to add some wax to the olive drab topcoats. Petrolatum and spermaceti were the waxes used. The coatings containing the waxes were no better in corrosion resistance, and in most cases worse, than the coatings without wax. A coating of wax was applied over some of the coating systems, also. Unless the wax was applied in a very heavy coat, no improvements were seen.

E. <u>Silane Treatment of Olive Drab Pigments</u>

Since most of the problems encountered during the duration of this contract were galvanic corrosion failures, it was decided to try to stop the electrolyte from connecting the anode and cathode electrically. If this could be accomplished, the galvanic cell would be short circuited and no galvanic corrosion could occur. It was believed the electrolyte either penetrated the paint film by wick action directly through pigment particles or penetrated through the pigment-resin interface. The latter was probably a weak link since the organophobic nature of most pigments prevents their surfaces from being properly wetted by resins. If either of these conditions was responsible for the generally poor galvanic corrosion resistance shown by most coating systems, the problem theoretically could be solved by making the pigment surfaces more organophilic. One way of doing this is by treating the pigments with silanes.

If a pigment is properly treated with a silane, its surface will become extremely water repellent. Based on the surface area of a pigment, enough silane is used to provide a monomolecular layer. The silane reacts chemically with the pigment, orienting itself with the organic portion of it outward, presenting a hydrophobic, organophilic surface.

The following procedure was used to treat all pigments:

1. The amount of silane necessary to treat each pigment was calculated. Lampblack, for example, with a surface area of 38 square meters per gram would require 0.095 grams of Union Carbide A-154 to provide a monomolecular layer

of silane. This figure was based on the silane supplier's figure of 400 square meters per gram of A-154 silane.

2. The moisture content of each pigment was adjusted by adding water or ammonium hydroxide (as recommended by the silane supplier). The water (or ammonium hydroxide) was thoroughly distributed throughout the pigment by placing the wetted pigment in a can and tumbling for several hours on pebble mill rollers.
3. The necessary amount of silane was then added and the container was tumbled an additional 4 hours.
4. The pigment was removed from the can and air dried. Pigment treated with A-154 was dried at 300°F for 1 hour to remove as much excess hydrochloric acid as possible.
5. A small amount of the treated pigment was tested for wettability by stirring in a beaker of water. Only pigment not wetted by water was used.

Five silanes, Union Carbide's A-154 (methyltrichlorosilane), A-162 (methyltriethoxysilane), Y-2525 (vinyltrimethoxysilane), Y-2815 (amyltrimethoxysilane), and Dow Corning Sylkyd 50, were evaluated. The A-154 silane reacted faster and more efficiently than the other materials but the HCl liberated reacted with some of the pigments and changed their color. The other materials caused no undesirable changes in color but reacted very slowly.

The treated pigments were used to prepare olive drab topcoats. These materials were applied over primers and evaluated for resistance to galvanic corrosion. All topcoats prepared from silane-treated pigments failed the bimetallic corrosion test within 150 hours.

F. Flexibility Study of 301-284-D Topcoat

Samples of the better coatings developed during the work on this contract were sent to the Coating and Chemical Laboratory, Aberdeen Proving Grounds, Maryland, for evaluation. A comment was made that the 301-284-D olive drab topcoat was lacking in flexibility.

Several things were tried in an attempt to improve the flexibility of this coating. They included:

a. Increasing the amount of Multron R-16 used.
b. Varying the proportions of all ingredients.
c. Adding a plasticizer other than Multron R-16.
d. Altering the PVC of this coating.
e. Using isocyanates other than Mondur CB-75.

It was found that removing the Multron R-16 and part of the Mondur CB-75 and catalyzing with Trancoa 560B provided the best flexibility. A topcoat made from this vehicle, 301-433-J, was almost perfect in galvanic corrosion resistance. A coating very similar to 301-433-J can be made by catalyzing 301-284-D with component C (see section B in the appendix) rather than component B, the normal catalyst used with 301-284-D.

G. Olive Drab Topcoats Containing Miscellaneous Vehicles

Olive Drab Topcoats were prepared from a number of miscellaneous vehicles. All were considered inferior to the best topcoats in galvanic corrosion resistance as can be seen from Table 77. No salt spray tests were performed.

Table 77

Bimetallic Corrosion Testing of Miscellaneous Olive Drab Topcoats

Primer Code	Topcoat Code	Topcoat Vehicle	Rating
301-103-A	301-315-C	Midland X-3928	2
301-275-E	301-315-C	Midland X-3928	2
301-103-A	301-334-C	Midland X-4415	2
301-275-E	301-334-C	Midland X-4415	2
301-103-A	301-349-C	Midland X-4323: Mondur CB-75	2
301-275-E	301-349-C	Midland X-4323: Mondur CB-75	2
301-103-A	301-349-D	Midland X-4323: Midland X-3934	2
301-275-E	301-349-D	Midland X-4323: Midland X-3934	2
301-103-A	301-408-A	Polylite 8703: Monostyrene	4
301-275-E	301-408-A	Polylite 8703: Monostyrene	4
301-103-A	301-408-B	Polylite 8702: Monostyrene	4
301-275-E	301-408-B	Polylite 8702: Monostyrene	4
301-103-A	301-409-A	Polylite 8703: Vinyltoluene	4
301-275-E	301-409-A	Polylite 8703: Vinyltoluene	4

Bimetallic Corrosion Rating System

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Section XI

Miscellaneous White Topcoat Work

A. Effect of Various White Pigments on Corrosion Resistance

Since very few of the initial white topcoats showed good corrosion resistance, it was decided to evaluate other white pigments for improved corrosion resistance. The pigments used were:

1. Antimony oxide
2. Zinc oxide
3. Zinc sulfide
4. Barium sulfate
5. Chloride process titanium dioxide

These pigments are represented by the symbols in Table 78. The vehicles used in these topcoats were:

1. Midland R-55
2. Dow Corning R-6-0031: Multron R-16: Mondur CB-75
3. Epon 1001: Dow Corning Z-6020

Table 78

Symbols Representing Pigments

A - Sulfate process titanium dioxide

B - Antimony oxide

C - Zinc sulfide

D - Barium sulfate

E - Chloride process titanium dioxide

F - Zinc oxide

The bimetallic corrosion results in Table 79 show the following pigment systems to be better than the sulfate process titanium dioxide pigmentation:

1. 65% sulfate type TiO_2: 35% zinc oxide
2. 50% sulfate process TiO_2: 50% zinc sulfide
3. 100% chloride process TiO_2.

B. <u>White Topcoats Containing Same Vehicles as Best Olive Drab Topcoats</u>

Based on the results obtained when other white pigments were used, some white topcoats were prepared using a combination of chloride process titanium dioxide and either zinc oxide, zinc sulfide, or barium sulfate. The same vehicles used in the best olive drab topcoats were used for this study. None of these materials was any better in corrosion resistance than the same coatings using the sulfate process titanium dioxide. Galvanic corrosion and salt spray results can be found in Tables 80 and 81.

Table 79

Bimetallic Corrosion Testing of Topcoats Containing Various White Pigments

Primer Code	Topcoat Code	Topcoat Vehicle	Pigment	Rating
301-103-A	301-210-H	Midland R-55	100% A	2
301-103-A	301-259-C	Midland R-55	85% A 15% B	2
301-103-A	301-259-B	Midland R-55	65% A 35% B	2
301-103-A	301-259-A	Midland R-55	50% A 50% B	2
301-103-A	301-327-K	Midland R-55	85% A 15% F	1
301-103-A	301-327-J	Midland R-55	65% A 35% F	1
301-103-A	301-327-H	Midland R-55	50% A 50% F	2
301-103-A	301-326-A	Midland R-55	100% F	2
301-103-A	301-328-E	Midland R-55	50% A 50% C	2
301-103-A	301-328-H	Midland R-55	50% A 50% D	2
301-103-A	301-326-J	Midland R-55	100% E	2
301-275-E	301-210-H	Midland R-55	100% A	2
301-275-E	301-259-C	Midland R-55	85% A 15% B	2
301-275-E	301-259-B	Midland R-55	65% A 35% B	2
301-275-E	301-259-A	Midland R-55	50% A 50% B	2
301-275-E	301-327-K	Midland R-55	85% A 15% F	2
301-275-E	301-327-J	Midland R-55	65% A 35% F	2

Table 79 (continued)

Bimetallic Corrosion Testing of Topcoats Containing Various White Pigments

Primer Code	Topcoat Code	Topcoat Vehicle	Pigment	Rating
301-275-E	301-327-H	Midland R-55	50% A 50% F	2
301-275-E	301-326-A	Midland R-55	100% F	2
301-275-E	301-328-E	Midland R-55	50% A 50% C	0
301-275-E	301-328-H	Midland R-55	50% A 50% D	2
301-275-E	301-326-J	Midland R-55	100% E	1
301-103-A	301-182-B	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	100% A	3
301-103-A	301-328-A	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	85% A 15% F	2
301-103-A	301-327-M	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	65% A 35% F	2
301-103-A	301-327-L	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	50% A 50% F	2
301-103-A	301-326-E	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	100% F	2
301-103-A	301-328-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	50% A 50% C	2
301-103-A	301-328-J	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	50% A 50% D	2
301-103-A	301-327-G	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	100% E	2
301-275-E	301-182-B	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	100% A	3
301-275-E	301-328-A	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	85% A 15% F	1
301-275-E	301-327-M	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	65% A 35% F	1

Table 79 (continued)

Bimetallic Corrosion Testing of Topcoats Containing Various White Pigments

Primer Code	Topcoat Code	Topcoat Vehicle	Pigment	Rating
301-275-E	301-327-L	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	50% A 50% F	1
301-275-E	301-326-E	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	100% F	3
301-275-E	301-328-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	50% A 50% C	0
301-275-E	301-328-J	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	50% A 50% D	1
301-275-E	301-327-G	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	100% E	1
301-103-A	301-183-B	Epon 1001: Dow Corning Z-6020	100% A	3
301-103-A	301-328-D	Epon 1001: Dow Corning Z-6020	85% A 15% F	2
301-103-A	301-328-C	Epon 1001: Dow Corning Z-6020	65% A 35% F	2
301-103-A	301-328-B	Epon 1001: Dow Corning Z-6020	50% A 50% F	2
301-103-A	301-327-B	Epon 1001: Dow Corning Z-6020	100% F	3
301-103-A	301-328-G	Epon 1001: Dow Corning Z-6020	50% A 50% C	2
301-103-A	301-329-A	Epon 1001: Dow Corning Z-6020	50% A 50% D	2
301-103-A	301-327-F	Epon 1001: Dow Corning Z-6020	100% E	2
301-275-E	301-183-B	Epon 1001: Dow Corning Z-6020	100% A	1
301-275-E	301-328-D	Epon 1001: Dow Corning Z-6020	85% A 15% F	2
301-275-E	301-328-C	Epon 1001: Dow Corning Z-6020	65% A 35% F	2

Table 79 (continued)

Bimetallic Corrosion Testing of Topcoats Containing Various White Pigments

Primer Code	Topcoat Code	Topcoat Vehicle	Pigment	Rating
301-275-E	301-328-B	Epon 1001: Dow Corning Z-6020	50% A 50% F	3
301-275-E	301-327-B	Epon 1001: Dow Corning Z-6020	100% F	3
301-275-E	301-328-G	Epon 1001: Dow Corning Z-6020	50% A 50% C	2
301-275-E	301-329-A	Epon 1001: Dow Corning Z-6020	50% A 50% D	2
301-275-E	301-327-F	Epon 1001: Dow Corning Z-6020	100% E	2

Symbols Representing Pigments

A - Sulfate process titanium dioxide

B - Antimony oxide

C - Zinc sulfide

D - Barium sulfate

E - Chloride process titanium dioxide

F - Zinc oxide

Bimetallic Corrosion Rating System

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 80

Bimetallic Corrosion Testing of White Topcoats Containing Same Vehicles as Best Olive Drab Topcoats

Primer Code	Topcoat Code	Topcoat Vehicle	Pigment	Rating
301-275-E	301-376-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	65% E 35% F	3
301-275-E	301-377-B	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	50% E 50% C	3
301-275-E	301-377-E	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	50% E 50% D	2
301-275-E	301-376-G	Midland R-55	65% E 35% F	2
301-275-E	301-377-A	Midland R-55	50% E 50% C	3
301-275-E	301-377-D	Midland R-55	50% E 50% D	2
301-275-E	301-376-H	Epon 1001: Dow Corning Z-6020	65% E 35% F	3
301-275-E	301-377-C	Epon 1001: Dow Corning Z-6020	50% E 50% C	2
301-275-E	301-377-F	Epon 1001: Dow Corning Z-6020	50% E 50% D	2

Symbols Representing Pigments

A - Sulfate process titanium dioxide
B - Antimony oxide
C - Zinc sulfide
D - Barium sulfate
E - Chloride process titanium dioxide
F - Zinc oxide

Bimetallic Corrosion Rating System

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 81

5% Salt Spray Testing of White Topcoats Containing Same Vehicles as Best Olive Drab Topcoats

Primer Code	Topcoat Code	Adhesion	Results	Hours Tested
301-275-E	301-376-F	0	Some very small blisters; slight corrosion on scribe.	2000
301-275-E	301-377-B	0	Many very small blisters; slight corrosion on scribe.	2000
301-275-E	301-377-E	0	Many very small blisters; slight corrosion on scribe.	2000
301-275-E	301-376-G	0	Some very small blisters; few small blisters and slight corrosion on scribe.	2000
301-275-E	301-377-A	0	Many very small blisters; slight corrosion on scribe.	2000
301-275-E	301-377-D	0	Some very small blisters; slight corrosion on scribe.	2000
301-275-E	301-376-H	0	Few very small blisters; one small blister and slight corrosion on scribe.	2000
301-275-E	301-377-C	0	Many very small blisters; few small blisters and slight corrosion on scribe.	2000
301-275-E	301-377-F	0	Many very small blisters; slight corrosion on scribe.	2000

Adhesion Rating System

Rating	Description	Rating	Description
0	Excellent Adhesion	0	Excellent Adhesion
1	Less than 10% failure, topcoat from primer	1P	Less than 10% failure, primer from substrate
2	10-25% failure, topcoat from primer	2P	10-25% failure, primer from substrate
3	25-50% failure, topcoat from primer	3P	25-50% failure, primer from substrate
4	50-75% failure, topcoat from primer	4P	50-75% failure, primer from substrate
5	Complete lifting of topcoat from primer	5P	Complete lifting of primer from substrate

C. Effect of Various Extender Pigments on Corrosion Resistance

All previous work on white topcoats had been done using only talc as the extender pigment. In addition, the pigment content had been kept constant at 53% by weight. It was then decided to evaluate a number of inert pigments at a wide range of pigment contents. The following extender pigments were chosen for evaluation:

(1) calcium carbonate
(2) micronized talc
(3) Cab-O-Sil
(4) Santocel 54
(5) Syloid 162

Pigment content was varied from 20 to 70% by weight.

The bimetallic corrosion results in Table 82 indicate the following combination of inert pigments and pigment contents to be better than the initial combination:

(1) Talc at 70 or 53% pigment
(2) Santocel 54 or Syloid 162 at 20% pigment

Only a representative number of these coatings were tested for salt spray resistance. The coatings were all very similar in salt spray performance as can be seen in Table 83.

Table 82

Bimetallic Corrosion Testing of White Topcoats Containing Various Extender Pigments

Primer Code	Topcoat Code	Topcoat Vehicle	Extender Pigment	% Pigment	Rating
301-275-E	301-364-A	Midland R-55	$CaCO_3$	70	3
301-275-E	301-364-G	Midland R-55	$CaCO_3$	60	2
301-275-E	301-360-H	Midland R-55	$CaCO_3$	53	2
301-275-E	301-365-J	Midland R-55	Talc	70	2
301-275-E	301-368-B	Midland R-55	Talc	53	2
301-275-E	301-368-C	Midland R-55	Talc	35	3
301-275-E	301-360-G	Midland R-55	Santocel 54	53	2
301-275-E	301-363-D	Midland R-55	Santocel 54	35	2
301-275-E	301-360-F	Midland R-55	Syloid 162	53	1
301-275-E	301-363-C	Midland R-55	Syloid 162	35	2
301-275-E	301-360-E	Midland R-55	CAB-O-SIL	53	1
301-275-E	301-363-B	Midland R-55	CAB-O-SIL	35	2
301-275-E	301-364-C	Dow Corning XR-6-0000: Dow Corning Z-6020	$CaCO_3$	70	2
301-275-E	301-364-J	Dow Corning XR-6-0000: Dow Corning Z-6020	$CaCO_3$	60	4
301-275-E	301-361-E	Dow Corning XR-6-0000: Dow Corning Z-6020	$CaCO_3$	53	3
301-275-E	301-365-K	Dow Corning XR-6-0000: Dow Corning Z-6020	Talc	70	3
301-275-E	301-368-A	Dow Corning XR-6-0000: Dow Corning Z-6020	Talc	53	2
301-275-E	301-368-D	Dow Corning XR-6-0000: Dow Corning Z-6020	Talc	35	3
301-275-E	301-361-B	Dow Corning XR-6-0000: Dow Corning Z-6020	Santocel 54	53	2
301-275-E	301-363-G	Dow Corning XR-6-0000: Dow Corning Z-6020	Santocel 54	35	2
301-275-E	301-361-D	Dow Corning XR-6-0000: Dow Corning Z-6020	Syloid 162	53	2
301-275-E	301-363-J	Dow Corning XR-6-0000: Dow Corning Z-6020	Syloid 162	35	2
301-275-E	301-361-C	Dow Corning XR-6-0000: Dow Corning Z-6020	CAB-O-SIL	53	2
301-275-E	301-363-H	Dow Corning XR-6-0000: Dow Corning Z-6020	CAB-O-SIL	35	4

Table 82 (continued)

Bimetallic Corrosion Testing of White Topcoats Containing Various Extender Pigments

Primer Code	Topcoat Code	Topcoat Vehicle	Extender Pigment	% Pigment	Rating
301-275-E	301-364-B	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	$CaCO_3$	70	2
301-275-E	301-364-H	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	$CaCO_3$	60	1
301-275-E	301-368-E	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Talc	70	1
301-275-E	301-368-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Talc	53	1
301-275-E	301-369-C	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Talc	35	1
301-275-E	301-361-G	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Santocel 54	53	2
301-275-E	301-362-E	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Santocel 54	45	2
301-275-E	301-369-A	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Santocel 54	35	2
301-275-E	301-365-E	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Santocel 54	20	1
301-275-E	301-362-A	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Syloid 162	53	2
301-275-E	301-362-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Syloid 162	45	2
301-275-E	301-369-B	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Syloid 162	35	1
301-275-E	301-365-D	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Syloid 162	20	1
301-275-E	301-362-B	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	CAB-O-SIL	53	2
301-275-E	301-362-G	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	CAB-O-SIL	45	2
301-275-E	301-368-J	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	CAB-O-SIL	35	2
301-275-E	301-365-C	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	CAB-O-SIL	20	2

Bimetallic Corrosion Rating System

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 83

5% Salt Spray Testing of White Topcoats Containing Various Extender Pigments

Primer Code	Topcoat Code	Adhesion	Results	Hours Tested
301-275-E	301-364-B	0	Many very small blisters; slight corrosion on scribe.	2000
301-275-E	301-364-H	2	Some very small and few small blisters; slight corrosion on scribe.	2000
301-275-E	301-368-E	0	Many very small blisters; slight corrosion on scribe.	2000
301-275-E	301-368-F	0	Many very small blisters; slight corrosion on scribe.	2000
301-275-E	301-369-C	0	Many very small blisters; slight corrosion on scribe.	2000
301-275-E	301-361-G	-	Not Tested.	-
301-275-E	301-362-E	-	Not Tested.	-
301-275-E	301-369-A	0	Some very small blisters; slight corrosion on scribe.	2000
301-275-E	301-365-E	0	Many very small blisters; slight corrosion on scribe.	2000
301-275-E	301-362-A	-	Not Tested.	-
301-275-E	301-362-F	-	Not Tested.	-
301-275-E	301-369-B	0	Few very small blisters; slight corrosion on scribe.	2000
301-275-E	301-365-D	0	Many very small blisters; slight corrosion on scribe.	2000
301-275-E	301-362-B	-	Not Tested.	-
301-275-E	301-362-G	-	Not Tested.	-
301-275-E	301-368-J	-	Not Tested.	-
301-275-E	301-365-C	-	Not Tested.	-
301-275-E	301-360-G	0	Some very small blisters; slight corrosion on scribe.	2000
301-275-E	301-360-F	0	One small and few very small blisters; slight corrosion on scribe.	2000
301-275-E	301-360-E	0	Some very small blisters; slight corrosion on scribe.	2000
301-275-E	301-361-B	0	Many very small blisters; slight corrosion on scribe.	2000

Adhesion Rating System

Rating	Description	Rating	Description
0	Excellent Adhesion	0	Excellent Adhesion
1	Less than 10% failure, topcoat from primer	1P	Less than 10% failure, primer from substrate
2	10-25% failure, topcoat from primer	2P	10-25% failure, primer from substrate
3	25-50% failure, topcoat from primer	3P	25-50% failure, primer from substrate
4	50-75% failure, topcoat from primer	4P	50-75% failure, primer from substrate
5	Complete lifting of topcoat from primer	5P	Complete lifting of primer from substrate

D. Addition of Chromate and Aluminum Pigments to White Topcoats

Since the chromate pigments seemed to inhibit corrosion when used in primers, it was decided to add small quantities of chromates to some of the white topcoats. A series was also prepared with an addition of 1% aluminum pigment, based on total pigment. In the case of the chromates, 3% of the chromate pigments were used. All of these coatings were somewhat yellow in color.

The results of bimetallic corrosion testing contained in Table 84 show none of these coatings to be substantially better than the corresponding coatings without the chromate or aluminum pigments.

Table 84

Bimetallic Corrosion Testing of White Topcoats Containing Chromate and Aluminum Pigments

Primer Code	Topcoat Code	Topcoat Vehicle	Pigment	Rating
301-103-A	301-325-A	Midland R-55	Zinc Chromate	2
301-103-A	301-325-B	Midland R-55	Calcium Chromate	2
301-103-A	301-325-C	Midland R-55	Strontium Chromate	1
301-275-E	301-325-A	Midland R-55	Zinc Chromate	2
301-275-E	301-325-B	Midland R-55	Calcium Chromate	2
301-275-E	301-325-C	Midland R-55	Strontium Chromate	1
301-103-A	301-325-D	Epon 1001: Dow Corning Z-6020	Zinc Chromate	2
301-103-A	301-325-E	Epon 1001: Dow Corning Z-6020	Calcium Chromate	2
301-103-A	301-325-F	Epon 1001: Dow Corning Z-6020	Strontium Chromate	3
301-275-E	301-325-D	Epon 1001: Dow Corning Z-6020	Zinc Chromate	1
301-275-E	301-325-E	Epon 1001: Dow Corning Z-6020	Calcium Chromate	2
301-275-E	301-325-F	Epon 1001: Dow Corning Z-6020	Strontium Chromate	2
301-103-A	301-325-G	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Zinc Chromate	2
301-103-A	301-325-H	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Calcium Chromate	2
301-103-A	301-325-J	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Strontium Chromate	2
301-275-E	301-325-G	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Zinc Chromate	2
301-275-E	301-325-H	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Calcium Chromate	2
301-275-E	301-325-J	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Strontium Chromate	2
301-275-E	301-378-A	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Aluminum	3
301-275-E	301-378-B	Epon 1001: Dow Corning Z-6020	Aluminum	2
301-275-E	301-378-C	Midland R-55	Aluminum	3
301-275-E	301-378-D	Dow Corning XR-6-0000: Dow Corning Z-6020	Aluminum	3

Bimetallic Corrosion Rating System

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

E. White Topcoats Containing Same PVC as Olive Drab Topcoats

Since all the original white topcoats had pigment volume concentrations considerably lower than the olive drab topcoats, it was decided to prepare some white topcoats which had PVC's equal to the olive drab topcoats.

The olive drab coatings, as can be seen from Table 85 were better in galvanic corrosion resistance than the corresponding white materials. The white topcoat made from the R-6-0031: BRS-2600 was a dark buff in color and developed cracks while drying.

Table 85

Bimetallic Corrosion Testing of White Topcoats with Same PVC as Olive Drab Topcoats

Primer Code	Topcoat Code	Topcoat Vehicle	Color	Rating
301-275-E	301-264-B	Dow Corning R-6-0031: Bakelite BRS-2600	Olive Drab	1
301-275-E	301-429-A	Dow Corning R-6-0031: Bakelite BRS-2600	White	N.T.
301-275-E	301-284-D	Dow Corning R-6-0031: Bakelite BRS-2600	Olive Drab	0
301-275-E	301-429-B	Dow Corning R-6-0031: Bakelite BRS-2600	White	2
301-275-E	301-270-C	Midland R-55	Olive Drab	1
301-275-E	301-429-C	Midland R-55	White	2

<u>Bimetallic Corrosion Rating System</u>

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

F. Previously Eliminated White Topcoats

Since the study of various white and extender pigments indicated the initial pigmentation used in the white topcoats might not be optimum, some of the white topcoats which originally were borderline in performance were re-evaluated with the new pigmentation. The vehicles in these topcoats were:

(1) Dow Corning R-6-0031: ½" RS Nitrocellulose

(2) Dow Corning DC-805: ½" Cellulose Acetate Butyrate

(3) General Electric SR-82: Formvar 7/70

While the galvanic corrosion resistance of some of these white coatings was marginally better than that of the original coatings, not enough improvement was shown to warrant further testing. Galvanic corrosion results can be found in Table 86.

Table 86

Bimetallic Corrosion Testing of Previously Eliminated White Topcoats

Primer Code	Topcoat Code	Topcoat Vehicle	Pigment	Extender Pigment	Pigment Content	Rating
301-103-A	301-163-B	Dow Corning R-6-0031: ½" RS Nitrocellulose	100% A	Talc	53%	3
301-103-A	301-386-D	Dow Corning R-6-0031: ½" RS Nitrocellulose	100% E	Syloid 162	35%	2
301-103-A	301-387-D	Dow Corning R-6-0031: ½" RS Nitrocellulose	65% E 35% F	Syloid 162	35%	2
301-103-A	301-388-D	Dow Corning R-6-0031: ½" RS Nitrocellulose	50% E 50% C	Syloid 162	35%	3
301-275-E	301-163-B	Dow Corning R-6-0031: ½" RS Nitrocellulose	100% A	Talc	53%	3
301-275-E	301-386-A	Dow Corning R-6-0031: ½" RS Nitrocellulose	100% E	Syloid 162	53%	2
301-275-E	301-386-B	Dow Corning R-6-0031: ½" RS Nitrocellulose	100% E	Talc	53%	2
301-275-E	301-386-C	Dow Corning R-6-0031: ½" RS Nitrocellulose	100% E	$CaCO_3$	70%	3
301-275-E	301-386-D	Dow Corning R-6-0031: ½" RS Nitrocellulose	100% E	Syloid 162	35%	2
301-275-E	301-386-E	Dow Corning R-6-0031: ½" RS Nitrocellulose	100% E	Syloid 162	20%	2
301-275-E	301-387-A	Dow Corning R-6-0031: ½" RS Nitrocellulose	65% E 35% F	Syloid 162	53%	2
301-275-E	301-387-B	Dow Corning R-6-0031: ½" RS Nitrocellulose	65% E 35% F	Talc	53%	2
301-275-E	301-387-C	Dow Corning R-6-0031: ½" RS Nitrocellulose	65% E 35% F	$CaCO_3$	70%	3
301-275-E	301-387-D	Dow Corning R-6-0031: ½" RS Nitrocellulose	65% E 35% F	Syloid 162	35%	2
301-275-E	301-387-E	Dow Corning R-6-0031: ½" RS Nitrocellulose	65% E 35% F	Syloid 162	20%	2
301-275-E	301-388-A	Dow Corning R-6-0031: ½" RS Nitrocellulose	50% E 50% C	Syloid 162	53%	2

Table 86 (continued)

Bimetallic Corrosion Testing of Previously Eliminated White Topcoats

Primer Code	Topcoat Code	Topcoat Vehicle	Pigment	Extender Pigment	Pigment Content	Rating
301-275-E	301-388-B	Dow Corning R-6-0031: ½" RS Nitrocellulose	50% E 50% C	Talc	53%	2
301-275-E	301-388-C	Dow Corning R-6-0031: ½" RS Nitrocellulose	50% E 50% C	$CaCO_3$	70%	2
301-275-E	301-388-D	Dow Corning R-6-0031: ½" RS Nitrocellulose	50% E 50% C	Syloid 162	35%	2
301-275-E	301-388-E	Dow Corning R-6-0031: ½" RS Nitrocellulose	50% E 50% C	Syloid 162	20%	2
301-103-A	301-163-F	Dow Corning DC-805: ½" CAB	100% A	Talc	53%	3
301-103-A	301-389-D	Dow Corning DC-805: ½" CAB	100% E	Syloid 162	35%	2
301-103-A	301-392-D	Dow Corning DC-805: ½" CAB	65% E 35% F	Syloid 162	35%	2
301-103-A	301-393-D	Dow Corning DC-805: ½" CAB	50% E 50% C	Syloid 162	35%	2
301-275-E	301-163-F	Dow Corning DC-805: ½" CAB	100% A	Talc	53%	2
301-275-E	301-389-A	Dow Corning DC-805: ½" CAB	100% E	Syloid 162	53%	2
301-275-E	301-389-B	Dow Corning DC-805: ½" CAB	100% E	Talc	53%	2
301-275-E	301-389-C	Dow Corning DC-805: ½" CAB	100% E	$CaCO_3$	70%	2
301-275-E	301-389-D	Dow Corning DC-805: ½" CAB	100% E	Syloid 162	35%	2
301-275-E	301-389-E	Dow Corning DC-805: ½" CAB	100% E	Syloid 162	20%	2
301-275-E	301-392-A	Dow Corning DC-805: ½" CAB	100% E	Syloid 162	53%	2

Table 86 (continued)

Bimetallic Corrosion Testing of Previously Eliminated White Topcoats

Primer Code	Topcoat Code	Topcoat Vehicle	Pigment	Extender Pigment	Pigment Content	Rating
301-275-E	301-392-B	Dow Corning DC-805: ½" CAB	65% E 35% F	Talc	53%	2
301-275-E	301-392-C	Dow Corning DC-805: ½" CAB	65% E 35% F	$CaCO_3$	70%	2
301-275-E	301-392-D	Dow Corning DC-805: ½" CAB	65% E 35% F	Syloid 162	35%	2
301-275-E	301-392-E	Dow Corning DC-805: ½" CAB	65% E 35% F	Syloid 162	20%	2
301-275-E	301-393-A	Dow Corning DC-805: ½" CAB	50% E 50% C	Syloid 162	53%	3
301-275-E	301-393-B	Dow Corning DC-805: ½" CAB	50% E 50% C	Talc	53%	3
301-275-E	301-393-C	Dow Corning DC-805: ½" CAB	50% E 50% C	$CaCO_3$	70%	3
301-275-E	301-393-D	Dow Corning DC-805: ½" CAB	50% E 50% C	Syloid 162	35%	2
301-275-E	301-393-E	Dow Corning DC-805: ½" CAB	50% E 50% C	Syloid 162	20%	2
301-103-A	301-163-E	General Electric SR-82: Formvar 7/70	100% A	Talc	53%	2
301-103-A	301-394-D	General Electric SR-82: Formvar 7/70	100% E	Syloid 162	35%	3
301-103-A	301-395-D	General Electric SR-82: Formvar 7/70	65% E 35% F	Syloid 162	35%	3
301-103-A	301-396-D	General Electric SR-82: Formvar 7/70	50% E 50% C	Syloid 162	35%	5

Table 86 (continued)

Bimetallic Corrosion Testing of Previously Eliminated White Topcoats

Primer Code	Topcoat Code	Topcoat Vehicle	Pigment	Extender Pigment	Pigment Content	Rating
301-275-E	301-163-E	General Electric SR-82: Formvar 7/70	100% A	Talc	53%	2
301-275-E	301-394-A	General Electric SR-82: Formvar 7/70	100% E	Syloid 162	53%	2
301-275-E	301-394-B	General Electric SR-82: Formvar 7/70	100% E	Talc	53%	3
301-275-E	301-394-C	General Electric SR-82: Formvar 7/70	100% E	$CaCO_3$	70%	3
301-275-E	301-394-D	General Electric SR-82: Formvar 7/70	100% E	Syloid 162	35%	3
301-275-E	301-394-E	General Electric SR-82: Formvar 7/70	100% E	Syloid 162	20%	2
301-275-E	301-395-A	General Electric SR-82: Formvar 7/70	65% E 35% F	Syloid 162	53%	4
301-275-E	301-395-B	General Electric SR-82: Formvar 7/70	65% E 35% F	Talc	53%	4
301-275-E	301-395-C	General Electric SR-82: Formvar 7/70	65% E 35% F	$CaCO_3$	70%	4
301-275-E	301-395-D	General Electric SR-82: Formvar 7/70	65% E 35% F	Syloid 162	35%	5
301-275-E	301-395-E	General Electric SR-82: Formvar 7/70	65% E 35% F	Syloid 162	20%	4
301-275-E	301-396-A	General Electric SR-82: Formvar 7/70	50% E 50% C	Syloid 162	53%	3
301-275-E	301-396-B	General Electric SR-82: Formvar 7/70	50% E 50% C	Talc	53%	3
301-275-E	301-396-C	General Electric SR-82: Formvar 7/70	50% E 50% C	$CaCO_3$	70%	5
301-275-E	301-396-D	General Electric SR-82: Formvar 7/70	50% E 50% C	Syloid 162	35%	5
301-275-E	301-396-E	General Electric SR-82: Formvar 7/70	50% E 50% C	Syloid 162	20%	3

Table 86 (continued)

Bimetallic Corrosion Testing of Previously Eliminated White Topcoats

Symbols Representing Pigments

A - Sulfate process titanium dioxide

B - Antimony oxide

C - Zinc sulfide

D - Barium sulfate

E - Chloride process titanium dioxide

F - Zinc oxide

Bimetallic Corrosion Rating System

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

G. Silane Treatment of White Pigments

As in the case of the olive drab pigments, sulfate process titanium dioxide was treated with silanes. Once again topcoats made from the treated pigments were inferior in galvanic corrosion resistance to coatings made from untreated pigments. Coatings containing pigments which had been treated by the silane supplier were equally unsatisfactory.

H. White Topcoats Made from Miscellaneous Vehicles

A number of miscellaneous vehicles were used to prepare white topcoats. None of these coatings were considered satisfactory. Bimetallic corrosion results may be found in Table 87.

Table 87

Bimetallic Corrosion Testing of White Topcoats Using Miscellaneous Vehicles

Primer Code	Topcoat Code	Topcoat Vehicle	Rating
301-103-A	301-334-B	Midland X-4415	2
301-275-E	301-334-B	Midland X-4415	2
301-275-E	301-351-A	Midland X-4323: Mondur CB-75	2
301-275-E	301-351-B	Midland X-4323: Midland X-3934	2
301-275-E	301-434-F	Dow Corning XR-6-0000: Dow Corning XZ-2-2023	2

Bimetallic Corrosion Rating System

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Section XII

Miscellaneous Testing

A. Optimum Thickness of Primer and Topcoat

As mentioned earlier, both primers and topcoats were applied at thicknesses of 0.0015". It was decided to try one system with thicknesses of 0.0005", 0.0010", and 0.0015" for both primer and topcoat. The primer chosen was the 301-103-A Midland R-55 system while the topcoat was the olive drab coating made from the same vehicle. It was determined that any thickness of topcoat would be satisfactory if 0.0015" of primer was used. In addition, if the heaviest thickness of topcoat is used, 0.0010" of primer will produce a satisfactory coating. While it is apparent that a thickness less than 0.0015" for both primer and topcoat may not be necessary for optimum protection, it is believed desirable to use as heavy a coating as possible for best results.

B. Exterior Exposure Panels

Some of the preferred olive drab systems were applied to a variety of substrates and exposed at the following test sites:

1. South Florida
2. South Florida Tidewater
3. Waukegan, Illinois

The coating systems exposed were:

	Primer	Topcoat
1.	301-103-A	301-270-C
2.	301-103-A	301-284-D
3.	301-275-E	301-270-C
4.	301-275-E	301-284-D
5.	301-275-E	301-264-B
6.	407 wash primer	301-270-C
7.	407 wash primer	301-284-D
8.	407 wash primer	301-264-B

The following substrates were used for the testing:

1. Dow 17 treated HK-31 magnesium alloy.
2. 24ST aluminum alloy.
3. Cold rolled steel.
4. Bonderite 1000 treated cold rolled steel.
5. Dow 17 treated HK-31 magnesium alloy coupled with 24ST aluminum alloy.
6. Dow 17 treated HK-31 magnesium alloy coupled with cold rolled steel.

These panels are presently being tested. After 12 months exposure, the following developments have occurred:

1. The 60° gloss on all panels has decreased from around 25° to 0°.
2. All panels have developed a heavy bronzing.

3. All coatings have shown medium to pronounced fading.

4. Film integrity of all coatings is excellent.

C. Evaluation of Clear Coatings

Since a great deal of time is necessary to prepare pigmented coatings, it was decided to check the possibility of testing a promising vehicle as a clear over primers for resistance to galvanic corrosion. Only those vehicles which performed well in the clear would then be made into pigmented coatings. This idea was tried and it was felt that it would be satisfactory for any future galvanic corrosion testing.

It was also decided to evaluate some of these clear coatings over some of the better white topcoats. To obtain the necessary low gloss, however, some Syloid 162 was used to flat these clears. The flatted clears were susceptible to water penetration and consequent galvanic corrosion failure.

D. Riveted Bimetallic Panels

Since all bimetallic corrosion testing had been done using the galvanic "cells", it was believed desirable to prepare some coupled panels and test them for resistance to 5% salt spray. Panels were prepared coupling Dow 17 treated HK-31 magnesium panels with either cold rolled steel or 24ST aluminum alloy panels.

The panels were fastened with 5056S aluminum alloy rivets. It was impossible, when coupling the panels in this manner, to completely eliminate the air space between the panels where the two metals lapped. It was also impossible to cover this space when applying the primer and topcoat by spray.

Panels joined in this manner were sprayed with some of the preferred coating systems and placed in a 5% salt spray cabinet. All failed within 48 hours due to severe corrosion of the magnesium. In each case the corrosion occurred at the unprotected lapped portion of the panel.

Duplicate panels were prepared. This time, however, some unreduced primer was placed in a syringe and applied to the problem area. The panels were primed, topcoated, and tested as before. There was a dramatic improvement in results. (See figs. 11 and 12) Almost all systems developed no more than a few small blisters within 500 hours. Most coupled panels on exterior exposure testing were protected in this manner.

E. Baked Coatings

While the provisions of this contract call for an air dry coating, it was agreed that we should bake some of the preferred systems to determine if baking would improve their corrosion resistance. A cure of 15 minutes at 350°F. was chosen. In all cases, only the 301-275-E primer was used.

The 301-284-D and 301-270-C systems were improved only slightly by the bake. The 301-264-A system was unaffected after 500 hours in the galvanic cell, however. The 301-284-D system also was perfect when cured 30 minutes at 400°F.

FIG. 11

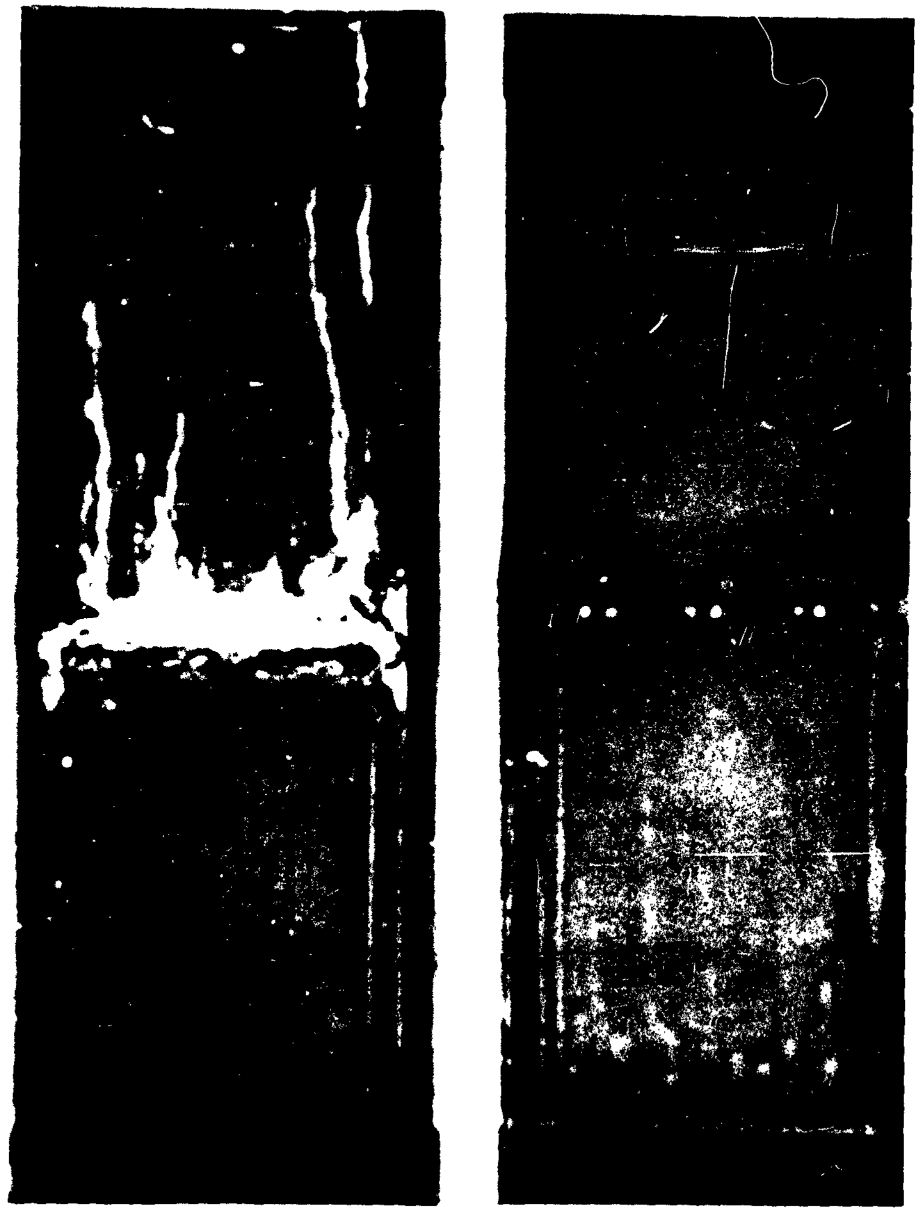


Fig. 11

5% SALT SPRAY RESULTS (ON MAGNESIUM-STEEL COUPLED PANELS)

OF OLIVE DRAB COATING SYSTEM WITHOUT AND WITH PROTECTION OF LAPPED AREA

FIG. 12

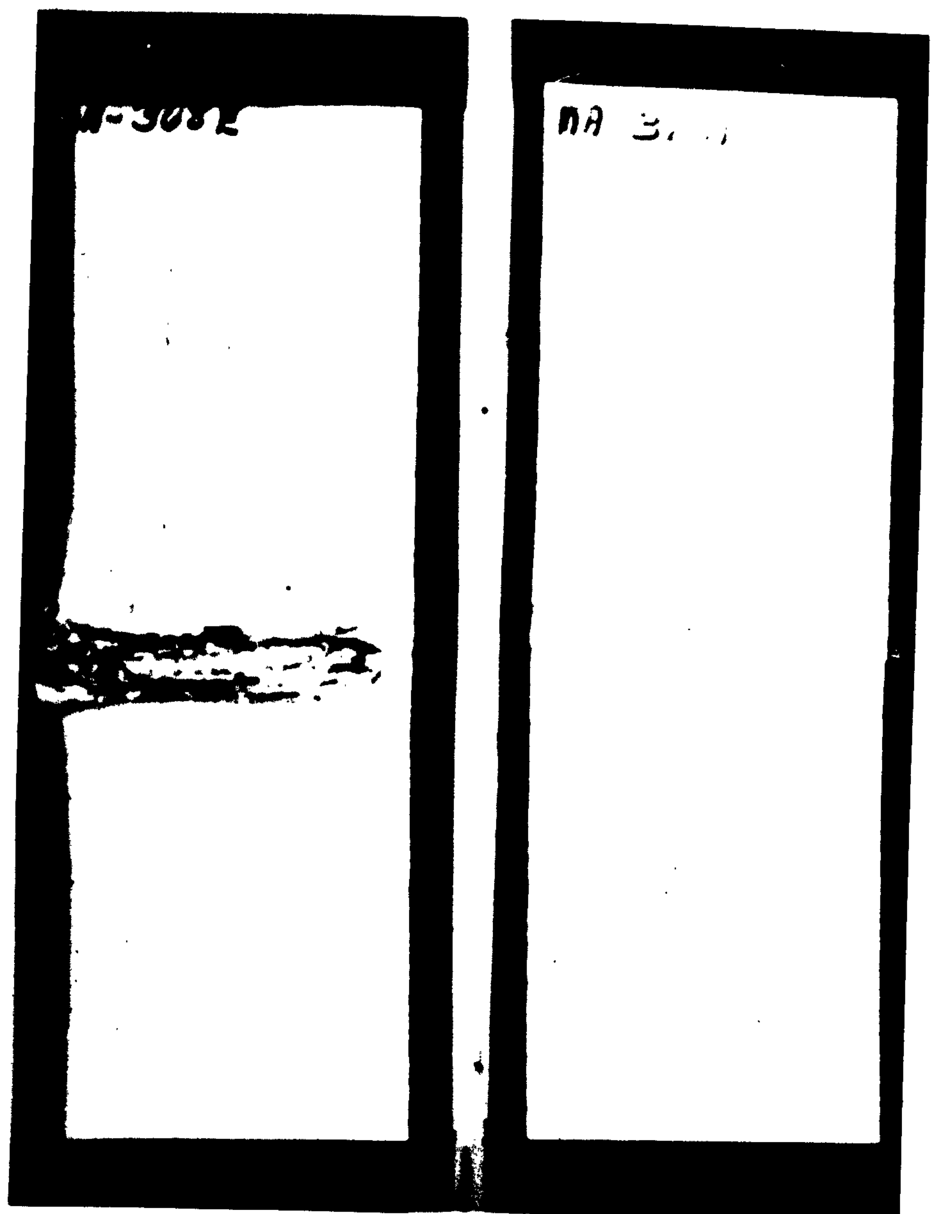


Fig. 12

5% SALT SPRAY RESULTS (ON MAGNESIUM-STEEL COUPLED PANELS) OF WHITE COATING SYSTEM WITHOUT AND WITH PROTECTION OF LAPPED AREA.

F. <u>Final Testing of Preferred Systems</u>

All of the promising coating systems developed were, of course, subjected to bimetallic and salt spray corrosion testing. In addition, they were tested for resistance to MIL-S-3136 fluid and diester lubricant. The coatings were also tested for heat stability. The results of these tests can be found in Table 88.

All of these coating systems are regarded as having satisfactory resistance to the test fluids. Those coatings which soften in the fluids soften only slightly and recover full hardness within 24 hours. The coatings which are indicated as being satisfactory for heat resistance are so rated because no flaking of the coating has occurred. Most of them, however, do become quite inflexible but are still not easily removed from the substrate. The 301-360-F material became very dark brown in color and the 301-368-F coating was only slightly less dark. All of the olive drab coatings will withstand 2 hour exposures to temperatures as high as 600°F. without flaking off the panel although their film integrity is definitely adversely affected by the increase in temperature.

Table 88

Final Testing of Preferred Coating Systems

Primer Code	Topcoat Code	MIL-S-3136 Fluid		Lubricant		Heat Exposure
		4 hr. Immersion	24 hr. Recovery	4 hr. Immersion	24 hr. Recovery	2 hours at 500F.
301-103-A	301-284-D	U	-	U	-	N.G.
301-275-E	301-284-D	U	-	U	-	O.K.
301-103-A	301-270-C	S	YES	U	-	O.K.
301-275-E	301-270-C	S	YES	U	-	O.K.
301-275-E	301-264-B	S	YES	U	-	O.K.
301-103-A	301-278-C	S	YES	U	-	O.K.
301-275-E	301-278-C	U	-	U	-	O.K.
301-103-A	301-278-E	S	YES	U	-	O.K.
301-275-E	301-360-F	S	YES	U	-	O.K.
301-275-E	301-368-F	U	-	U	-	O.K.

Key to Symbols

Film Integrity

O.K. - No perceptible change except for darkening.

B - Blistered

N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected

S - Softened

D - Dissolved

24 Hour Recovery

Yes - Recovered original properties

No - Did not recover original properties

Section XIII

Additional Research

The preceding sections of the report cover the work done during the contracted time. It was decided that several promising areas required additional work and the contract was extended for the necessary time.

A. Vinyl Coatings

Bakelite's XYHL, VAGH, and QYNV were screened in clear coatings. The XYHL and VAGH were combined with an isocyanate and/or tetrabutyl titanate. The results of the screening may be found in Table 89.

B. Epoxy Coatings

The complete range of epoxy resins was catalyzed with varying amounts of an isocyanate. Screening test results may be found in Table 90.

Table 89

Screening of Vinyl Resin Systems

Vehicle Code	Type of Resin	Air Dried Film		MIL-S-3136 Fluid		Lubricant		Comments
		Dry	Adhesion	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery	
301-442-C	85% XYHL 15% Mondur CB-75	0	0	U	-	U	-	--
301-442-D	QYNV	0	3	S	Yes	S	Yes	--
301-442-EA	88% VAGH 12% Mondur CB-75	0	0	U	-	U	-	Brittle
301-442-EB	84% VAGH 16% Mondur CB-75	0	0	U	-	U	-	Brittle
301-442-EC	80% VAGH 20% Mondur CB-75	0	0	U	-	U	-	Brittle
301-462-A	99.5% VAGH 0.5% Tetrabutyltitanate	1	1	U	-	U	-	--
301-462-B	99% VAGH 1% Tetrabutyltitanate	0	0	U	-	U	-	--
301-462-C	98% VAGH 2% Tetrabutyltitanate	0	0	U	-	U	-	--
301-462-D	96% VAGH 4% Tetrabutyltitanate	1	0	U	-	U	-	--

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

Table 90

Screening of Epoxy-Polyurethane Systems

Vehicle Code	Type of Resin	Air Dried Film		MIL-S-3136 Fluid		Lubricant		Comments
		Dry	Adhesion	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery	
301-459-A	70% Dow Corning XR-6-0000 30% Mondur CB-75	1	0	S	YES	U	-	-
301-459-B	66% Dow Corning XR-6-0000 34% Mondur CB-75	1	0	S	NO	U	-	-
301-459-C	62% Dow Corning XR-6-0000 38% Mondur CB-75	0	1	S	NO	U	-	Brittle
301-459-D	62% Epon 828 38% Mondur CB-75	2	1	S	NO	S	NO	Soft
301-459-E	57% Epon 828 43% Mondur CB-75	2	1	S	NO	S	NO	Soft
301-459-F	50% Epon 828 50% Mondur CB-75	0	1	S	NO	S	NO	Slightly Brittle
301-459-G	54% Epon 834 46% Mondur CB-75	3	1	S	NO	S	NO	Soft
301-459-H	50% Epon 834 50% Mondur CB-75	1	1	S	NO	[illegible]	-	Brittle
301-459-J	43% Epon 834 57% Mondur CB-75	1	2	S	NO	S	NO	Brittle
301-459-K	52% Epon 1002 48% Mondur CB-75	1	1	U	-	U	-	Brittle

Table 90 (continued)

Screening of Epoxy-Polyurethane Systems

Vehicle Code	Type of Resin	Air Dried Film		MIL-S-3136 Fluid		Lubricant		Comments
		Dry	Adhesion	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery	
301-460-A	52% Epon 1002 48% Mondur CB-75	1	1	U	-	U	-	Slightly Brittle
301-460-B	40% Epon 1002 60% Mondur CB-75	0	0	U	-	U	-	Slightly Brittle
301-460-C	57% Epon 1007 43% Mondur CB-75	1	1	U	-	U	-	Brittle
301-460-D	53% Epon 1007 47% Mondur CB-75	1	1	U	-	U	-	Brittle
301-460-E	47% Epon 1007 53% Mondur CB-75	1	1	U	-	U	-	Brittle
301-469-A	57% Epon 872 43% Mondur CB-75	1	0	S	YES	D	-	-
301-469-B	64% Epon 872 36% Mondur CB-75	1	0	S	YES	S	NO	-
301-469-C	70% Epon 872 30% Mondur CB-75	1	0	S	YES	S	NO	-
301-469-D	73% Epon 872 27% Mondur CB-75	1	0	S	YES	S	NO	-

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

C. Silicone-Polyester Coatings Catalyzed with Isocyanates and Amines

Since we had earlier found a silicone-polyester catalyzed with an isocyanate to produce a coating with most of the properties needed, some additional testing was done in this area. Two experimental silicone-polyester copolymers were catalyzed with Mondur CB-75 and screened in the usual manner. In addition, Dow Corning Z-6020 aminosilane and triethylamine (TEA) were also evaluated as catalysts. The test results may be found in Table 91.

D. Miscellaneous Materials

A number of other polymers were also screened. Some of these were chosen because similar types of materials had previously performed well. Others were included because their chemical type had not been studied before and their omission would prevent this contract from being as complete as it could be.

Table 91

Screening of Silicone-Polyesters Catalyzed with Isocyanates and Amines

Vehicle Code	Type of Resin	Air Dried Film		MIL-S-3136 Fluid		Lubricant		Comments
		Dry	Adhesion	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery	
301-458-A	84% X-4633; 10% Mondur CB-75	0	1	U	-	U	-	-
301-458-B	74% X-4633; 26% Mondur CB-75	0	0	U	-	U	-	-
301-458-C	63% X-4633; 37% Mondur CB-75	0	0	U	-	U	-	-
301-458-D	50% X-4633; 50% Mondur CB-75	0	0	U	-	U	-	Slightly Brittle
301-458-E	98% X-4633; 2% Dow Corning Z-6020	1	0	S	NO	S	NO	Brittle
301-458-F	95% X-4633; 5% Dow Corning Z-6020	1	0	S	NO	S	YES	Brittle
301-458-G	90% X-4633; 10% Dow Corning Z-6020	1	0	S	NO	U	-	Brittle
301-458-H	98% Dow Corning R-6-0031; 2% Dow Corning Z-6020	1	1	S	NO	S	NO	-
301-458-J	95% Dow Corning R-6-0031; 5% Dow Corning Z-6020	1	1	S	NO	S	NO	-
301-458-K	90% Dow Corning R-6-0031; 10% Dow Corning Z-6020	1	1	S	NO	S	NO	Slightly Brittle

Table 91 (continued)

Screening of Silicone-Polyesters Catalyzed with Isocyanates and Amines

Vehicle Code	Type of Resin	Air Dried Film		MIL-S-3136 Fluid		Lubricant		Comments
		Dry	Adhesion	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery	
301-460-F	99% Dow Corning R-6-0031; 1% TEA	2	1	S	NO	S	NO	Soft
301-460-G	98% Dow Corning R-6-0031; 2% TEA	2	1	S	NO	S	NO	Soft
301-460-H	95% Dow Corning R-6-0031; 5% TEA	2	1	S	NO	S	NO	Brittle
301-460-J	99% X-4633; 1% TEA	1	1	S	NO	S	NO	Brittle
301-460-K	98% X-4633; 2% TEA	1	1	S	NO	S	NO	Brittle
301-460-L	95% X-4633; 5% TEA	1	1	S	NO	S	NO	Brittle
301-473-A	83% X-4636; 17% Mondur CB-75	0	0	U	-	U	-	Brittle
301-473-B	72% X-4636; 27% Mondur CB-75	0	0	U	-	U	-	Brittle
301-473-C	63% X-4636; 37% Mondur CB-75	0	0	U	-	U	-	Brittle
301-473-D	50% X-4636; 50% Mondur CB-75	0	0	U	-	U	-	Brittle

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Film Integrity

O.K. - No perceptible change except for darkening
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

Included in the latter group are some materials not normally associated with coatings. In many cases it was necessary to use unusual solvents or to apply the coatings from dispersion to obtain continuous films. Some materials also required the use of heat but for preliminary screening purposes were not eliminated for this reason. Attempts were made to obtain inorganic polymers but these materials were unavailable. The screening results may be found in Table 92.

E. <u>Bimetallic Corrosion and Salt Spray Testing of Primers and Clear Coatings</u>

A number of the clear coatings in sections XIII A-D (above) were believed worthy of additional testing. These materials were evaluated in the normal manner for resistance to galvanic corrosion. The clears were tested over unprimed Dow 17 treated HK-31 magnesium alloy and/or over the same substrate primed with 301-275-E calcium chromate primer. In addition some of these resin systems were incorporated into calcium chromate primers. Some isocyanate catalyzed silicone copolymers were also tested in the galvanic cells. The silicone copolymers include Midland X-4641, X-4646, X-4664, X-4649, X-4661, X-4676, Dow Corning XR-6-0066, XR-6-0059, and XR-6-0041. Galvanic corrosion test results may be found in Table 93.

Table 92

Screening of Miscellaneous Materials

Vehicle Code	Type of Resin	Air Dried Film		MIL-S-3136 Fluid		Lubricant		Comments
		Dry	Adhesion	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery	
301-442-A	Pennsalt Kynar Dispersion	0	0	U	-	U	-	-
301-442-B	Pennsalt Kynar Solution	1	3	S	YES	S	YES	Soft
301-453-A	Firestone Exon 461	1	1	S	YES	U	-	-
301-453-B	3M Kel-F 800	1	2	S	YES	U	-	-
301-453-C	3M Kel-F Fluorel	3	2	U	-	S	NO	-
301-446-A	DuPont Zytel 61	1*	0	U	-	U	-	-
301-445-F	43% Epon 828: 57% Zytel 61	2	1	U	-	U	-	Soft
301-445-G	41% Epon 828: 54% Zytel 61: 5% DET	2	1	U	-	U	-	Soft
301-445-H	41% Epon 828: 54.5% Zytel 61: 4.5% DET	2	1	U	-	U	-	Soft
301-445-J	41.5% Epon 828: 55.0% Zytel 61: 3.5% DET	2	1	S	YES	S	YES	Soft
301-445-K	42.0% Epon 828: 55.0% Zytel 61: 3.0% DET	2	1	S	NO	S	NO	Soft
301-455-A	9% Epon 828: 91% Zytel 61	1	1	U	-	U	-	Soft
301-455-B	17% Epon 828: 83% Zytel 61	1	1	U	-	U	-	Soft
301-455-C	23% Epon 828: 77% Zytel 61	1	1	U	-	U	-	Soft
301-472-B	93% Zytel 61: 7% Mondur CB-75	1	2	U	-	U	-	Soft
301-472-C	82% Zytel 61: 18% Mondur CB-75	1	1	U	-	U	-	-
301-472-D	69% Zytel 61: 31% Mondur CB-75	1	1	U	-	U	-	-
301-472-E	57% Zytel 61: 43% Mondur CB-75	1	1	U	-	U	-	-
301-472-F	47% Zytel 61: 53% Mondur CB-75	1	1	U	-	U	-	-

* BAKED

Table 92 (continued)
Screening of Miscellaneous Materials

Vehicle Code	Type of Resin	Air Dried Film		MIL-S-3136 Fluid		Lubricant		Comments
		Dry	Adhesion	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery	
301-445-C	25% Epon 1001; 37% Epon 828; 6% DMP-10; 32% Thiokol LP-3 Polysulfide	0	0	S	YES	S	YES	Eyeholes
301-446-C	Thiokol LP-3 Polysulfide	5	5	-	-	-	-	-
301-446-D	Thiokol LP-3 Polysulfide	5	5	-	-	-	-	-
301-446-B	Thiokol FA Polysulfide Rubber	0*	2	U	-	U	-	Soft
301-452-A	DuPont Adiprene L-167 Polyurethane Rubber	1	2	U	-	S	NO	-
301-452-B	91% Adiprene L-167; 9% Versamid 115	3	1	S	NO	S	NO	-
301-452-C	97% Adiprene L-167; 3% Tetrabutyltitanate	3	1	D	-	S	NO	-
301-452-D	99.9% Adiprene L-167; 0.1% Tetrabutyltitanate	2	1	U	-	U	-	Slow Cure
301-461-C	87% Thiokol LP-3; 13% Triethylenetetramine	1	1	U	-	U	-	-
301-461-A	92% Epon 1002; 4% Tetrabutyltitanate; 4% Diethylene Triamine	1	0	U	-	U	-	-
301-454-A	DuPont Delrin	0*	1	U	-	U	-	Brittle
301-447-A	Goodyear Vitel 200	1	1	U	-	U	-	-

Table 92 (continued)

Screening of Miscellaneous Materials

Vehicle Code	Type of Resin	Air Dried Film		MIL-S-3136 Fluid		Lubricant		Comments
		Dry	Adhesion	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery	
301-447-F	Goodyear Vitel 207	2	2	S	NO	S	NO	-
301-447-G	50% Goodyear Vitel 200; 50% Vitel 207	2	1	S	YES	S	YES	-
301-447-C	38% Vitel 200; 62% VYHH	1	1	S	YES	U	-	-
301-447-D	18% Vitel 200; 82% VYHH	1	2	S	YES	U	-	-
301-447-E	67% Vitel 200; 33% VYHH	1	1	U	-	U	-	-
301-447-H	73% Vitel 200; 27% Exon 461	1	1	S	NO	U	-	-

* BAKED

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor

Film Integrity

O.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties
No - Did not recover original properties

Table 93

Bimetallic Corrosion Testing of Primers and Clear Coatings

Coating Code	Primed with 301-275-E	Pigmentation	Coating Vehicle	Rating
301-442-A	Yes	Clear *	Pennsalt Kynar Vinylidene Fluoride Dispersion	1
301-442-C	Yes	Clear	Bakelite XYHL; Mondur CB-75	4
301-442-D	Yes	Clear *	Bakelite QYNV Organosol	0
301-442-EA	Yes	Clear	Bakelite VAGH; Mondur CB-75	3
301-445-C	Yes	Clear	Epon 828; Epon 1001; Thiokol LP-3	4
301-446-B	Yes	Clear *	Thiokol FA Polysulfide Rubber	2
301-453-A	No	Clear	Firestone Exon 461 Fluorinated Copolymer	2
301-453-A	Yes	Clear	Firestone Exon 461 Fluorinated Copolymer	2
301-453-B	No	Clear	3M Kel-F 800 Fluorinated Copolymer	2
301-453-B	Yes	Clear	3M Kel-F 800 Fluorinated Copolymer	2
301-467-C	No	Calcium Chromate	Firestone Exon 461	5
301-467-E	No	Calcium Chromate	3M Kel-F 800	5
301-447-A	Yes	Clear	Goodyear Vitel 200 Polyester	1
301-467-A	No	Zinc Chromate	Goodyear Vitel 200 Polyester	4
301-467-B	No	Calcium Chromate	Goodyear Vitel 200 Polyester	4
301-447-[illegible]	Yes	Clear	Goodyear Vitel 200; Bakelite VYHH	1

Table 93 (continued)

Bimetallic Corrosion Testing of Primers and Clear Coatings

Coating Code	Primed with 301-275-E	Pigmentation	Coating Vehicle	Rating
301-452-A	Yes	Clear	DuPont Adiprene L-167 Polyurethane Rubber	2
301-470-A	No	Calcium Chromate	DuPont Adiprene L-167 Polyurethane Rubber	5
301-454-A	No	Clear *	DuPont Delrin Acetal	5
301-461-A	Yes	Clear	Epon 1002; Tetrabutyltitanate; Diethylenetriamine	2
301-471-A	No	Calcium Chromate	Epon 1002; Tetrabutyltitanate; Diethylenetriamine	4
301-499-G	No	Clear	Hercules Penton Chlorinated Polyether	4
301-475-A	No	Calcium Chromate	Epon 834; Thiokol LP-3; Triethylenetetramine	5
301-490-B	No	Calcium Chromate	Bakelite PKDA 8500 Phenoxy Resin	5
301-490-D	No	Calcium Chromate	Bakelite PKDA 8500; Mondur CB-75	5
301-498-B	No	Calcium Chromate	Pennsalt Kynar Solution	4
301-500-A	No	Red Lead	Dow Corning XR-6-0000; Versamid 115	2
301-500-C	No	Red Lead	Tung Oil Phenolic Varnish	2
301-500-D	No	Red Lead	Midland R-55 Epoxy Ester	2
302-404-A	No	Calcium Chromate	Dow Corning XR-6-0000; Versamid 115: General Electric SC-50 Sodium Methyl Siliconate	2
301-459-A	No	Clear	Dow Corning XR-6-0000; Mondur CB-75	2

Table 93 (continued)

Bimetallic Corrosion Testing of Primers and Clear Coatings

Coating Code	Primed with 301-275-E	Pigmentation	Coating Vehicle	Rating
301-458-C	No	Clear	Midland X-4633; Mondur CB-75	2
301-470-C	No	Calcium Chromate	Midland X-4633; Mondur CB-75	5
301-479-A	No	Clear	Midland X-4641; Mondur CB-75	2
301-483-A	No	Calcium Chromate	Midland X-4641; Mondur CB-75	4
301-479-B	No	Clear	Midland X-4646; Mondur CB-75	2
301-479-C	No	Clear	Midland X-4678; Mondur CB-75	2
301-479-D	No	Clear	Midland X-4664; Mondur CB-75	2
301-483-C	No	Calcium Chromate	Midland X-4664; Mondur CB-75	4
301-479-E	No	Clear	Midland X-4649; Mondur CB-75	3
301-479-G	No	Clear	Midland X-4661; Mondur CB-75	3
301-479-H	No	Clear	Midland X-4676; Mondur CB-75	2
301-478-B	No	Calcium Chromate	Midland X-4636; Mondur CB-75	5
301-482-K	No	Calcium Chromate	Midland X-4717; Mondur CB-75	5
301-483-B	No	Calcium Chromate	Midland X-4648; Mondur CB-75	2
301-483-E	No	Calcium Chromate	Midland X-4714; Mondur CB-75	5

Table 93 (continued)

Bimetallic Corrosion Testing of Primers and Clear Coatings

Coating Code	Primed with 301-275-E	Pigmentation	Coating Vehicle	Rating
301-483-F	No	Calcium Chromate	Midland X-4716; Mondur CB-75	5
301-494-A	No	Calcium Chromate	Midland X-4728; Mondur CB-75	2
301-494-B	No	Calcium Chromate	Midland X-4770; Mondur CB-75	2
301-479-J	No	Clear	Dow Corning XR-6-0066; 2.5% Mondur CB-75	4
301-479-K	No	Clear	Dow Corning XR-6-0066; 5% Mondur CB-75	4
301-479-L	No	Clear	Dow Corning XR-6-0066; 7.5% Mondur CB-75	4
301-482-A	No	Clear	Dow Corning XR-6-0059; 2.5% Mondur CB-75	4
301-482-B	No	Clear	Dow Corning XR-6-0059; 5% Mondur CB-75	5
301-482-C	No	Clear	Dow Corning XR-6-0059; 7.5% Mondur CB-75	5
301-482-G	No	Clear	Dow Corning XR-6-0059; 12% Mondur CB-75	5
301-482-D	No	Clear	Dow Corning XR-6-0041; 2.5% Mondur CB-75	5
301-482-E	No	Clear	Dow Corning XR-6-0041; 5% Mondur CB-75	5
301-482-F	No	Clear	Dow Corning XR-6-0041; 7.5% Mondur CB-75	5
301-482-H	No	Clear	Dow Corning XR-6-0031; Mondur CB-75	2

* BAKED

Bimetallic Corrosion Rating System

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Some of these coatings were also applied to Dow 17 treated HK-31 magnesium alloy and tested for resistance to 5% salt spray. Salt spray exposure results may be found in Table 94.

A number of other primer type coatings were evaluated. These included the following:

1. International Rustproof Irco I.O.X. 1011 and Irco 9301. These materials were used as additives in the silicone-epoxy: polyamide primer.

2. Hercules Powder Co. Rosin Amine D. This material was added to the same primer.

3. Amercoat Corporation Dimetcote #4 zinc silicate coating.

4. Napko Corporation Zacrote #1360 zinc silicate coating.

5. Union Carbide Ucar R-101 and R-104 silicone metal treatments. These materials were used as an undercoat for the silicone-epoxy: polyamide primer. The Dow Corning R-6-0031: Mondur CB-75 white topcoat was used.

Bimetallic corrosion testing results may be found in Table 95.

Table 94

5% Salt Spray Testing of Primers and Clear Coatings

Coating Code	Primed with 301-275-E	Results	Hours Tested
301-442-A	Yes	Few very small blisters; slight corrosion and few small blisters on scribe.	2000
301-442-C	Yes	Many small and very small blisters.	2000
301-442-D	Yes	Slight corrosion on scribe.	2000
301-442-EA	Yes	Some very small blisters; few small blisters on scribe.	2000
301-445-C	Yes	Slight corrosion and few small blisters on scribe.	2000
301-447-A	Yes	Few very small blisters; slight corrosion on scribe.	2000
301-447-E	Yes	Few small and very small blisters; slight corrosion and few small blisters on scribe.	2000
301-453-A	No	Few very small blisters; slight corrosion and few small blisters on scribe.	2000
301-453-A	Yes	Many very small blisters; slight corrosion on scribe.	2000
301-453-B	No	Few very small blisters; slight corrosion and few small blisters on scribe.	2000
301-453-B	Yes	Few small and some very small blisters.	2000
301-452-A	Yes	Few very small blisters; slight corrosion and few small blisters on scribe.	2000
301-454-A	Yes	Slight corrosion, some small and very small blisters; slight corrosion on scribe.	2000
301-461-A	Yes	Few very small blisters.	2000
301-467-A	No	Many small and very small blisters, slight corrosion.	2000
301-467-B	No	Many small and very small blisters.	2000
301-467-C	No	Severe corrosion.	2000
301-467-E	No	Severe corrosion.	2000

Table 95

Bimetallic Corrosion Testing of Miscellaneous Primers

Coating Code	Coating Type	Rating
301-488-A	Dow Corning XR-6-0000; Versamid 115 Plus IRCO I.O.X. 1011	4
301-488-B	Dow Corning XR-6-0000; Versamid 115 Plus IRCO 9301	4
301-488-C	Dow Corning XR-6-0000; Versamid 115 Plus Rosin Amine D	4
301-491-A	Napko Corporation Zacrote #1360 Inorganic Coating	5
301-491-C	Amercoat Corporation Dimetcote #4 Inorganic Coating	5
301-491-E	Union Carbide Ucar R-101 Plus Primer and Topcoat	1
301-491-F	Union Carbide Ucar R-104 Plus Primer and Topcoat	0

Bimetallic Corrosion Rating System

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

F. Bimetallic Corrosion Testing of Olive Drab and White Topcoats

Several of the vehicles mentioned in the preceding sections were incorporated into olive drab and white topcoats and evaluated for resistance to galvanic corrosion. In each case, the 301-275-E silicone-epoxy calcium chromate primer was used. Some of the coatings tested were the preferred materials developed earlier in the contract. Many of these coatings were baked to determine their optimum corrosion resistance. Bimetallic corrosion testing results may be found in Tables 96 and 97.

G. Bimetallic Salt Spray Testing of White Coating Systems

Since the Union Carbide UCAR R-101 and R-104 metal treatments seemed to inhibit galvanic corrosion, some riveted panels were prepared for salt spray testing. Each coating system consisted of either UCAR R-101 or R-104, followed by 301-275-E silicone-epoxy: polyamide primer, and topcoated with 301-368-F silicone-polyester: polyurethane white topcoat. Magnesium panels were coupled with steel or aluminum panels. Two panels of each variation were prepared, one being coated in the normal manner and the other having the lapped area protected with a layer of unreduced primer. The bimetallic salt spray corrosion results may be found in Table 98.

Table 96

Bimetallic Corrosion Testing of Olive Drab Topcoats

Coating Code	Bake	Coating Vehicle	Rating
301-112-B	-	Dow Corning R-6-0031: ½" RS Nitrocellulose	2
301-443-A	5 min. @400°F.	Pennsalt Kynar Dispersion	2
301-264-B	-	1:1 Bakelite BRS-2600: Dow Corning R-6-0031	2
301-264-B	15 min. @350°F.	1:1 Bakelite BRS-2600: Dow Corning R-6-0031	0
301-270-C	-	Midland R-55 Epoxy Ester	1
301-270-C	15 min. @350°F.	Midland R-55 Epoxy Ester	1
301-284-D	-	Dow Corning R-6-0031: Mobay Mondur CB-75: Multron R-16	1
301-284-D	15 min. @350°F.	Dow Corning R-6-0031: Mobay Mondur CB-75: Multron R-16	1
301-284-D	30 min. @400°F.	Dow Corning R-6-0031: Mobay Mondur CB-75: Multron R-16	0
301-284-A	15 min. @350°F.	Dow Corning R-6-0031: Mobay Multron R-16	2
301-433-J	-	Dow Corning R-6-0031: Trancoa 560B	1
301-433-J	30 min. @400°F.	Dow Corning R-6-0031: Trancoa 560B	1
301-433-G	-	Dow Corning R-6-0031: Multron R-16: Mondur CB-75: Trancoa 560B	1
301-433-G	30 min. @400°F.	Dow Corning R-6-0031: Multron R-16: Mondur CB-75: Trancoa 560B	3
301-433-K	-	Dow Corning R-6-0031: Multron R-16: Trancoa 560B	1
301-433-K	30 min. @400°F.	Dow Corning R-6-0031: Multron R-16: Trancoa 560B	1
301-466-A	-	3:1 Bakelite BRS-2600: Dow Corning R-6-0031	2
301-467-D	-	Firestone Exon 461	2
301-467-F	-	3M Kel-F 800	2
301-484-B	-	301-284-D with lower pigmentation.	2
301-485-A	-	301-466-A with lower pigmentation.	2

Bimetallic Corrosion Rating System

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 97

Bimetallic Corrosion Testing of White Topcoats

Coating Code	Pigmentation	Coating Vehicle	Rating
301-182-B	TiO_2: Talc	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	2
301-360-B	TiO_2: Talc	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	2
301-368-F	TiO_2: Silica	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	2
301-434-E	TiO_2	Dow Corning XR-6-0000: Dow Corning XZ-2-2023	2
301-434-F	TiO_2: Talc	Dow Corning XR-6-0000: Dow Corning XZ-2-2023	2
301-498-A	TiO_2	Pennsalt Kynar Solution	4
301-498-G	White Lead: Talc	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	2
301-499-C	TiO_2 Calcium Silicate	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	2
301-499-D	TiO_2 Barytes	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	2

Bimetallic Corrosion Rating System

Rating	Hours Exposed	Condition of Panel
0	500	Perfect
1	500	Very few very small blisters or slight discoloration.
2	500	Many small and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 98

Bimetallic Salt Spray Testing of White Coating Systems

Coating	Coupling	Lapped Area Protected	Results	Hours Tested
UCAR 101	Magnesium: Steel	Yes	Slight corrosion on magnesium, slight blistering on steel.	1200
UCAR 101	Magnesium: Aluminum	Yes	Few small blisters on magnesium.	1200
UCAR 101	Magnesium: Steel	No	Severe blistering and corrosion of magnesium at lapped area.	170
UCAR 101	Magnesium: Aluminum	No	Severe blistering and corrosion of magnesium at lapped area.	170
UCAR 104	Magnesium: Steel	Yes	Few small blisters and slight corrosion of magnesium.	1200
UCAR 104	Magnesium: Aluminum	Yes	Few small blisters.	1200
UCAR 104	Magnesium: Steel	No	Severe blistering and corrosion of magnesium at lapped area.	170
UCAR 104	Magnesium: Aluminum	No	Severe blistering and corrosion of magnesium at lapped area.	170

NOTE: All the above coating systems displayed poor adhesion of the primer to the UCAR R-101 or R-104 at the conclusion of this test.

Section XIV

A. Summary

The following is a summary of results of work done on this contract:

1. 301-275-E silicone-epoxy copolymer primer is the preferred primer. 301-103-A silicone-epoxy ester primer is not as highly recommended because of three problems:

   a. Adhesion of topcoats to this primer is far inferior to the adhesion of topcoats to the 301-275-E primer.

   b. This primer is far more sensitive to lifting which may be caused by any strong solvents present in the topcoats.

   c. The cure of this primer is quite variable which causes inconsistencies in recoatability, performance, etc.

2. The following olive drab topcoats, listed in order of preference, are the best that were developed:

   a. 301-284-D silicone polyurethane
   b. 301-270-C epoxy ester
   c. 301-264-B silicone phenolic
   d. 301-278-C silicone-epoxy copolymer
   e. 301-278-E silicone-epoxy copolymer

3. Although no completely satisfactory white topcoat has been developed, the following are superior to others tested:

   a. 301-360-F epoxy ester

   b. 301-368-F silicone polyurethane

   Formulas for all coatings are listed in the appendix.

4. It is believed that galvanic corrosion resistance is directly related to panel preparation. If coupled panels are properly protected around the lapped areas by the unthinned coating of primer, all the coating systems are satisfactory. If, however, no special precautions are taken, no coating will protect the magnesium from early failure.

B. Acknowledgement

The authors wish to acknowledge the invaluable suggestions and advice given to them throughout the contract by Dr. William D. Coder, Research Supervisor. They also wish to thank Mr. George K. Hughes, Section Head, Resin Research Laboratory, for the preparation of the experimental polymers used in this program.

Section XV

Appendix

A. Bibliography

1. Fitzgibbon, C.R., Miller, E.H., and Glaser, M.A., High Temperature Protective Coatings for Magnesium, Wright Air Development Center (1957).

B. <u>Formulations of Preferred Coatings</u>

All compositions are by weight and represent 100 gallons.

Primers

301-103-A Zinc Chromate Primer

Midland R-55 @50% NVM	450
Plaskon ST-847 @50% NVM	150
Imperial X-883 Zinc Chromate	163
Xylene	140
6% Cobalt Naphthenate	0.9
5% Calcium Naphthenate	1.5
4% Rare Earth Naphthenate	0.9
Exkin #1 (Nuodex)	1.3
Nilskin (Naftone)	1.3
	908.9

Weight per gallon - 9.09 pounds

Recommended thinners - Aromatic hydrocarbons

301-275-E Calcium Chromate Primer

Component A

Dow Corning XR-6-0000 @60% NVM	734
Mineral Pigments #1376 Calcium Chromate	314
National Lead Bentone 27	5
Toluene	12.5
Cellosolve	15
Methyl Isobutyl Ketone	12.5
	1093.0

Weight per gallon - 10.93 pounds

Component B

General Mills Versamid 115 @100% NVM	157
General Electric SR-82 @60% NVM	23
Toluene	177
Cellosolve	213
Methyl Isobutyl Ketone	177
	747

Weight per gallon - 7.47 pounds

Mix one volume component A with one volume component B just prior to application.

Recommended thinner -	Toluene	125 parts by weight
	Cellosolve	150 parts by weight
	Methyl isobutyl ketone	125 parts by weight

Topcoats

301-284-D Silicone Polyurethane Olive Drab Topcoat

Component A

Imperial X-1810 C.P. Chrome Yellow Medium	226
N.J. Zinc XX-50 Zinc Oxide	63
Mapico #516 Dark Red Iron Oxide	149
C.K. Williams Superjet Lampblack	53
#282 Clay	73
Johns Manville Celite #289	19
Davison Chemical Syloid 162	21
National Lead Bentone 27	5
Dow Corning R-6-0031 @50% NVM	487
Mobay Multron R-16 @100% NVM	56
Methyl Isobutyl Ketone	130
Dow Corning Paint Additive #1	1.5
	1283.5

Weight per gallon - 12.84 pounds

Component B

Mobay Mondur CB-75 @75% NVM	243
Methyl Isobutyl Ketone	275
Cellosolve Acetate (Polyurethane Grade)	275
	793

Weight per gallon - 7.93 pounds

Equal volumes of Components A and B should be mixed just before using.

Recommended thinners - Methyl isobutyl ketone or a mixture of methyl isobutyl ketone and aromatic hydrocarbons.

If more flexibility is desired, the following catalyst system might be used:

Component C

Trancoa Chemical Tranco 560B @60% NVM	440
Mobay Mondur CB-75 @75% NVM	56
Methyl Isobutyl Ketone	176
Cellosolve Acetate (Polyurethane Grade)	176
	848

Weight per gallon - 8.48 pounds

Equal volumes of Components A and C should be mixed just prior to application.

Recommended thinners - Methyl isobutyl ketone or a blend of methyl isobutyl ketone and aromatic hydrocarbons.

Catalyzing component A with component C (rather than the usual catalyst, component B) will result in a more flexible coating, similar to 301-433-J (see section X.F. page 282)

301-270-C Epoxy Ester Olive Drab Topcoat

Imperial X-1810 C.P. Chrome Yellow Medium	120
N.J. Zinc XX-50 Zinc Oxide	35
Mapico #516 Dark Red Iron Oxide	62
C.K. Williams Superjet Lampblack	26
#282 Clay	39
Johns Manville Celite #289	11
National Lead Bentone 27	3
Midland R-55 @50% NVM	548
Xylene	158
6% Cobalt Naphthenate	0.7
5% Calcium Naphthenate	1.3
4% Rare Earth Naphthenate	0.7
Exkin #1 (Nuodex)	1.1
Nilskin (Naftone)	1.1
Dow Corning Paint Additive #1	1.0
	1007.9

Weight per gallon - 10.08 pounds

Recommended thinners - Aromatic hydrocarbons

301-264-B Silicone Phenolic Olive Drab Topcoat

Imperial X-1810 C.P. Chrome Yellow Medium	172
N.J. Zinc XX-50 Zinc Oxide	41
Mapico #516 Dark Red Iron Oxide	85
C.K. Williams Superjet Lampblack	33
#282 Clay	47
Johns Manville Celite #289	12
National Lead Bentone 27	5
Dow Corning R-6-0031 @50% NVM	318
Bakelite BRS-2600 @55% NVM	289
Dow Corning Paint Additive #1	1
Methyl Isobutyl Ketone	126
	1129

Weight per gallon - 11.29 pounds

Recommended thinner - methyl isobutyl ketone.

301-278-C Silicone Epoxy Olive Drab Topcoat

Component A

Imperial X-1810 C.P. Chrome Yellow Medium	224
Red Lead	119
N.J. Zinc XX-50 Zinc Oxide	64
Mapico #516 Dark Red Iron Oxide	88
C.K. Williams Superjet Lampblack	43
#282 Clay	74
Johns Manville Celite #289	19.5
National Lead Bentone 27	3.5
Dow Corning XR-6-0000 @60% NVM	416
Toluene	81
Cellosolve	97
Methyl Isobutyl Ketone	81
	1310.0

Weight per gallon - 13.10 pounds

Component B

General Mills Versamid 115 @100% NVM	83
Toluene	204
Cellosolve	245
Methyl Isobutyl Ketone	204
	736

Weight per gallon - 7.36 pounds

Mix equal volumes of components A and B just prior to application.

Recommended thinner -

Toluene	125 parts by weight
Cellosolve	150 parts by weight
Methyl isobutyl ketone	125 parts by weight

301-278-E Silicone Epoxy Olive Drab Topcoat

Component A

Imperial X-1810 C.P. Chrome Yellow Medium	222
Red Lead	118
N.J. Zinc XX-50 Zinc Oxide	64
Mapico #516 Dark Red Iron Oxide	87
C.K. Williams Superjet Lampblack	43
#282 Clay	73
Johns Manville Celite #289	19.5
National Lead Bentone 27	3.5
Midland X-4209 @62.5% NVM	412
Toluene	80
Cellosolve	96
Methyl Isobutyl Ketone	80
	1298.0

Weight per gallon - 12.98 pounds

Component B

General Mills Versamid 115 @100% NVM	86
Toluene	204
Cellosolve	245
Methyl Isobutyl Ketone	204
	739

Weight per gallon - 7.39 pounds

Mix equal volumes of components A and B just before application.

Recommended thinner -

Toluene	125 parts by weight
Cellosolve	150 parts by weight
Methyl isobutyl ketone	125 parts by weight

301-360-F Epoxy Ester White Topcoat

DuPont Ti-Pure R-610	264
Davison Chemical Syloid 162	27
Midland R-55 @50% NVM	506
Methyl Isobutyl Ketone	206
6% Cobalt Naphthenate	0.3
5% Calcium Naphthenate	0.5
4% Rare Earth Naphthenate	0.3
Exkin #1 (Nuodex)	0.4
Nilskin (Naftone)	0.4
	1004.9

Weight per gallon - 10.05 pounds

Recommended thinners - Aromatic hydrocarbons

301-368-F Silicone Polyurethane White Topcoat

Component A

DuPont Ti-Pure R-610	261
Micronized Talc	142
Dow Corning R-6-0031 @50% NVM	725
Mobay Multron R-16 @100% NVM	35
	1163

Weight Per Gallon - 11.63 pounds

Component B

Mobay Mondur CB-75 @75% NVM	99
Methyl Isobutyl Ketone	334
Cellosolve Acetate (Polyurethane Grade)	334
	767

Weight per gallon - 7.67 pounds

Mix equal volumes of components A and B just prior to application.

Recommended thinners - Methyl isobutyl ketone or a mixture of methyl isobutyl ketone and aromatic hydrocarbons.